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ABSTRACT

The use of a three-parameter logistic model for applying latent trait theory has become more popular because of the availability of computer programs. The program Logist 5 can be used not only for the item parameter estimation in the three-parameter logistic model, but also in the two parameter logistic model by setting the third parameter equal to zero. In the present study, comparison was made between the estimated item parameters obtained by assuming the normal ogive model and those obtained by Logist 5 assuming the two parameter logistic model. In some cases, item parameter estimation was also made by Logist 5 assuming the three-parameter logistic model, and comparison was extended to those results also. Data were obtained from the performance of fifth through ninth graders in Japan who took a battery of thirteen tests, Shiba's Word/Phrase Comprehension Tests. Results from four tests were chosen for this study. Resultant estimated item parameters were compared with those obtained using the tetrachoric methods. Results showed the mean and standard deviation of the distribution of the maximum likelihood estimate seem to be somewhat different from those of the distribution theta, and a certain systematic tendency was observed. (LMO)

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ONR/RR-84-2

# COMPARISON OF THE ESTIMATED ITEM PARAMETERS OF SHIBA'S WORD/PHRASE COMPREHENSION TESTS OBTAINED BY LOGIST 5 AND THOSE BY THE TETRACHORIC METHOD

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Stimulated by Lord's suggestion that LOGIST 5 can be used for equating even when the number of linking items is small, it was tested on Shiba's Word/Phrase Comprehension Test data. Combinations of four tests and two tests, and also a single test with different numbers of examinees, were chosen, for which LOGIST 5 was applied. The resultant estimated item parameters were compared with those obtained by the tetrachoric method. Some consistency was found in the results of certain tests in preference to those of certain other tests.

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# COMPARISON OF THE ESTIMATED ITEM PARAMETERS OF SHIBA'S WORD/PHRASE COMPREHENSION TESTS OBTAINED BY LOGIST 5 AND THOSE BY THE TETRACHORIC METHOD

## ABSTRACT

Stimulated by Lord's suggestion that Logist 5 can be used for equating even when the number of linking items is small, it was tested on Shiba's Word/Phrase Comprehension Test data. Combinations of four tests and two tests, and also a single test with different numbers of examinees, were chosen, for which Logist 5 was applied. The resultant estimated item parameters were compared with those obtained by the tetrachoric method. Some consistency was found in the results of certain tests in preference to those of certain other tests.

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The research was conducted at the principal investigator's laboratory, 405 Austin Peay Hall, Department of Psychology, University of Tennessee, Knoxville, Tennessee. Those who worked for her as assistants include Paul S. Changas, Lisa Lambert, Richard Strouse, and Alecia P. Long

## I. Introduction

In applying latent trait theory, or item response theory, perhaps two of the most frequently used models for binary test items are Rasch model (Rasch, 1960) and three-parameter logistic model (Birnbaum, 1968). In particular, three-parameter logistic model has become more and more popular in the past decade because of the availability of computer programs for estimating the three item parameters which are represented by Logist 5 (Wingersky, Barton and Lord, 1982).

This computer program, Logist 5, can be used not only for the item parameter estimation in the three-parameter logistic model, but also in the (two-parameter) logistic model, by setting the third parameter equal to zero. It is well known (Birnbaum, 1968) that (two-parameter) logistic model provides us with a good approximation to the normal ogive model if we set the scaling factor $D$ equal to 1.7 .

In the present study, using empirical data for which normal ogive model was originally assumed, comparison was made between the estimated item parameters obtained by assuming the normal ogive model and those obtained by Logist 5 assuming the (two-parameter) logistic model. In some cases, item parameter estimation was also made by Logist 5 assuming the three-parameter logistic model, and comparison was extended to those results also.

Empirical data adopted here were taken from the test data provided by the courtesy of Professor Sukeyori Shiba of the University of Tokyo. They are based upon the performance of fifth through ninth graders in Japan who took separate tests of Shiba's Word/Phrase Comprehension Tests.*

## II. Three-Parameter Logistic Model and Logist 5

Let $\theta$ be the latent trait, or ability, and $P_g(\theta)$ be the item characteristic function of the multiple-choice test item $g$, or the conditional probability with which the examinee answers item $g$ correctly, given ability $\theta$. In the three-parameter logistic model, this item characteristic function is given by

$$(2.1) \qquad P_g(\theta) = c_g + (1-c_g)\,\Psi_g(\theta) \quad ,$$

where $\Psi_g(\theta)$ is the item characteristic function in the (two-parameter) logistic model, for which we can write

$$(2.2) \qquad \Psi_g(\theta) = [1 + \exp\{-Da_g(\theta-b_g)\}]^{-1} \quad ,$$

with $a_g$ $(> 0)$ and $b_g$ as the item discrimination and difficulty parameters, respectively, and $D$ as the scaling factor which is usually set equal to $1.7$. The third parameter, $c_g$, in (2.1) is the guessing parameter, which is originally defined as unity divided by the number of alternative answers presented with the multiple-choice test item $g$. The model was originated from the assumption that the examinee either knows the answer to the question, or guesses randomly. Thus $P_g(\theta)$, or the operating characteristic of the binary item score $u_g = 1$, given $\theta$, is greater than $\Psi_g(\theta)$, which represents the conditional probability for the "knowledge." The discrepancy between the two functions is also a function of $\theta$, i.e., $[1 - \Psi_g(\theta)]$ divided by the number of alternatives.

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* The author is obliged to Dr. Hiroyuki Noguchi of Tokyo Gakugei University as well as Professor Shiba for providing her with these data.

Lord started calling this third parameter, $c_g$, pseudo-guessing parameter, after he had discovered that for many multiple-choice test items the estimated guessing parameter, $c_g$, substantially differs from unity divided by the number of alternatives, when the three-parameter logistic model was adopted for those items (Lord, 1968). This fact itself seems to be enough evidence to invalidate the three-parameter logistic model with respect to those specific multiple-choice test items. Researchers who adopt this model claim, however, that there should not be any harm as long as the curve is used as an approximation to the true item characteristic function.

It should be noted that Samejima has pointed out (Samejima, 1973) that, unlike the normal ogive and the logistic models, three-parameter logistic model does not satisfy the unique maximum condition (Samejima, 1969, 1972), which indicates that for some response patterns the likelihood function $L_V(\theta)$, i.e., the operating characteristic of the response pattern, $V$, may not have a unique maximum. This fact implies that the third parameter, $c_g$, can be a real nuisance, in the mathematical aspect of theory.

The item characteristic function in the normal ogive model is given by

$$(2.3) \qquad \Phi_g(\theta) = (2\pi)^{-1/2} \int_{-\infty}^{a_g(\theta-b_g)} \exp(-t^2/2)\, dt \quad ,$$

where $a_g$ $(> 0)$ and $b_g$ are the item discrimination and the item difficulty parameters, respectively. When the same values of parameters $a_g$ and $b_g$ are used in (2.2) with $D = 1.7$ , the curve represented by (2.2) is very close to the one represented by (2.3) for the entire range of $\theta$ (Birnbaum, 1968).

Logist 5 is a computer program developed by Lord and others (Wingersky, Barton and Lord, 1982) for the purpose of estimating the item discrimination parameter $a_g$ , the item difficulty parameter $b_g$ and the guessing parameter $c_g$ of each test item $g$ $(=1,2,\ldots,n)$ following the three-parameter logistic model, as well as the individual ability parameter $\theta_s$ of each examinee $s$ $(=1,2,\ldots,N)$ . The method is based upon the maximum likelihood estimation, with the likelihood function,

$$(2.4) \qquad L(U|\theta,A,B,C) = \prod_{s=1}^{N} \prod_{g=1}^{n} P_g(\theta_s)^{u_{gs}} \{1-P_g(\theta_s)\}^{1-u_{gs}} ,$$

where $u_{gs}$ is a binary item score of the examinee $s$ for item $g$ , $U$ is an (nxN) matrix of the binary item scores $u_{gs}$ , $\theta$ is the vector of order $N$ of the individual parameter $\theta_s$ , $A$ , $B$ and $C$

are the vectors of order n of the item parameters $a_g$, $b_g$ and $c_g$, respectively. Those (3n+N) parameters are estimated iteratively through the four sets of likelihood equations, with programming devices for efficiency in their convergence.

## III. Empirical Data Based upon Shiba's Word/Phrase Comprehension Tests

Shiba's research on the measurement of word/phrase comprehension has been introduced earlier (Samejima, 1980). The battery of tests used for the construction of Shiba's word/phrase comprehension scale consists of thirteen tests, AP1, AP2, A1. A2, A3, A4, A5, A6, J1, J2, S1, S2 and U. Each of these thirteen tests contains thirty to sixty multiple-choice items, each of which has a set of five alternatives. These tests differ in difficulty, and each is designed for a different age group of subjects, ranging from four years of age to the ages of college students. There are subsets of items included in two tests, which are adjacent to each other in difficulty. For example, items 37 through 56 of Test J1 are also items 1 through 20 of Test J2. There are 480 test items in total, and their participation in different tests are shown in Table 3-1. The number of examinees used for the ability scale construction varies between 219 preschoolers for Test AP1 and 924 second graders of senior high schools for Test S1.

In the present study, four tests were chosen out of these thirteen tests, i.e., A5, A6, J1 and J2. The examinees who took these four tests in Shiba's original data are as follows.

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## TABLE 3-1

Distribution of the 480 Test Items of Shiba's Word/Phrase Comprehension Item Pool among Thirteen Different Tests.

| Item No. | Tests | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2. | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 14 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 22 | 2 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 23 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 24 | 4 | 14 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 25 | 5 | 15 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 26 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 27 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 28 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 29 | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 30 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 34 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 36 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38 | 0 | 18 | 18 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39 | 0 | 19 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 43 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 44 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 46 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 48 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 0 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60 | 0 | 0 | 16 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 0 | 17 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 62 | 0 | 0 | [illegible] | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 0 | 20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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TABLE 3-1 (Continued)

| Item No. | Tests | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
| 64 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 76 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 77 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 78 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 79 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 0 | 0 | 0 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | 0 | 0 | 0 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82 | 0 | 0 | 0 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 83 | 0 | 0 | 0 | 14 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 84 | 0 | 0 | 0 | 15 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 0 | 0 | 0 | 16 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 86 | 0 | 0 | 0 | 17 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 87 | 0 | 0 | 0 | 18 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 88 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 91 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 92 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 93 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 94 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 96 | 0 | 0 | 0 | 27 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 0 | 0 | 0 | 28 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 98 | 0 | 0 | 0 | 29 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 0 | 0 | 0 | 30 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 | 31 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 101 | 0 | 0 | 0 | 32 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 102 | 0 | 0 | 0 | 33 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 103 | 0 | 0 | 0 | 34 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 106 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 108 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 109 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 114 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 115 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 116 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 117 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 118 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 119 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 121 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 122 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 123 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 124 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 125 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 126 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 127 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 128 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 129 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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TABLE 3-1 (Continued)

| Item No. | Tests | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
| 130 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 131 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 132 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 133 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 134 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 136 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 137 | 0 | 0 | 0 | 0 | 25 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 138 | 0 | 0 | 0 | 0 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 139 | 0 | 0 | 0 | 0 | 27 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 140 | 0 | 0 | 0 | 0 | 28 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 141 | 0 | 0 | 0 | 0 | 29 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 142 | 0 | 0 | 0 | 0 | 30 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 143 | 0 | 0 | 0 | 0 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 144 | 0 | 0 | 0 | 0 | 32 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 145 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 146 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 147 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 148 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 149 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 151 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 152 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 153 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 154 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 155 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 156 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 157 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 158 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 159 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 160 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 161 | 0 | 0 | 0 | 0 | 0 | 25 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 162 | 0 | 0 | 0 | 0 | 0 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 163 | 0 | 0 | 0 | 0 | 0 | 27 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 164 | 0 | 0 | 0 | 0 | 0 | 28 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 165 | 0 | 0 | 0 | 0 | 0 | 29 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 166 | 0 | 0 | 0 | 0 | 0 | 30 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 167 | 0 | 0 | 0 | 0 | 0 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 168 | 0 | 0 | 0 | 0 | 0 | 32 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 169 | 0 | 0 | 0 | 0 | 0 | 33 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 170 | 0 | 0 | 0 | 0 | 0 | 34 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 171 | 0 | 0 | 0 | 0 | 0 | 35 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 172 | 0 | 0 | 0 | 0 | 0 | 36 | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 173 | 0 | 0 | 0 | 0 | 0 | 37 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 174 | 0 | 0 | 0 | 0 | 0 | 38 | 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| 175 | 0 | 0 | 0 | 0 | 0 | 39 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 176 | 0 | 0 | 0 | 0 | 0 | 40 | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| 177 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| 178 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 179 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| 181 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| 182 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| 183 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 |
| 184 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| 185 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| 186 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 |
| 187 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 188 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| 189 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 |
| 190 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 191 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 |
| 192 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 |
| 193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 195 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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TABLE 3-1 (Continued)

| Item No. | Tests | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
| 196 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 197 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 198 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 199 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 201 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 205 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 206 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 211 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 1 | 0 | 0 | 0 | 0 | 0 |
| 212 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 2 | 0 | 0 | 0 | 0 | 0 |
| 213 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 3 | 0 | 0 | 0 | 0 | 0 |
| 214 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 4 | 0 | 0 | 0 | 0 | 0 |
| 215 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 5 | 0 | 0 | 0 | 0 | 0 |
| 216 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 6 | 0 | 0 | 0 | 0 | 0 |
| 217 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 7 | 0 | 0 | 0 | 0 | 0 |
| 218 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 8 | 0 | 0 | 0 | 0 | 0 |
| 219 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 9 | 0 | 0 | 0 | 0 | 0 |
| 220 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 10 | 0 | 0 | 0 | 0 | 0 |
| 221 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 11 | 0 | 0 | 0 | 0 | 0 |
| 222 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 12 | 0 | 0 | 0 | 0 | 0 |
| 223 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 13 | 0 | 0 | 0 | 0 | 0 |
| 224 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 14 | 0 | 0 | 0 | 0 | 0 |
| 225 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 15 | 0 | 0 | 0 | 0 | 0 |
| 226 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 16 | 0 | 0 | 0 | 0 | 0 |
| 227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 |
| 228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 |
| 229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 |
| 230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 |
| 231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 |
| 232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 |
| 233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 |
| 234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 |
| 235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 |
| 236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 |
| 237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 |
| 238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 |
| 239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 |
| 240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 |
| 241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 |
| 242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 |
| 243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 0 |
| 244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 |
| 245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 |
| 246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 0 |
| 247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 0 | 0 |
| 248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 0 | 0 | 0 |
| 249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 |
| 250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 |
| 251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 1 | 0 | 0 | 0 | 0 |
| 252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 2 | 0 | 0 | 0 | 0 |
| 253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 3 | 0 | 0 | 0 | 0 |
| 254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 4 | 0 | 0 | 0 | 0 |
| 255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 5 | 0 | 0 | 0 | 0 |
| 256 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 6 | 0 | 0 | 0 | 0 |
| 257 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 7 | 0 | 0 | 0 | 0 |
| 258 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 8 | 0 | 0 | 0 | 0 |
| 259 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 9 | 0 | 0 | 0 | 0 |
| 260 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 10 | 0 | 0 | 0 | 0 |
| 261 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 11 | 0 | 0 | 0 | 0 |

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TABLE 3-1 (Continued)

| Item No. | Tests | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
| 262 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 12 | 0 | 0 | 0 | 0 |
| 263 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 13 | 0 | 0 | 0 | 0 |
| 264 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 14 | 0 | 0 | 0 | 0 |
| 265 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 15 | 0 | 0 | 0 | 0 |
| 266 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 16 | 0 | 0 | 0 | 0 |
| 267 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 |
| 268 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 |
| 269 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 |
| 270 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 |
| 271 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 |
| 272 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 |
| 273 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 |
| 274 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 |
| 275 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| 276 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 |
| 277 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 |
| 278 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 |
| 279 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 |
| 280 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 |
| 281 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 |
| 282 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 |
| 283 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 |
| 284 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| 285 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 |
| 286 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 |
| 287 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 1 | 0 | 0 | 0 |
| 288 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 2 | 0 | 0 | 0 |
| 289 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 3 | 0 | 0 | 0 |
| 290 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 4 | 0 | 0 | 0 |
| 291 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 5 | 0 | 0 | 0 |
| 292 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 6 | 0 | 0 | 0 |
| 293 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 7 | 0 | 0 | 0 |
| 294 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 8 | 0 | 0 | 0 |
| 295 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 9 | 0 | 0 | 0 |
| 296 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 10 | 0 | 0 | 0 |
| 297 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 11 | 0 | 0 | 0 |
| 298 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 12 | 0 | 0 | 0 |
| 299 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 13 | 0 | 0 | 0 |
| 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 14 | 0 | 0 | 0 |
| 301 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 15 | 0 | 0 | 0 |
| 302 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 16 | 0 | 0 | 0 |
| 303 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 17 | 0 | 0 | 0 |
| 304 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 18 | 0 | 0 | 0 |
| 305 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 19 | 0 | 0 | 0 |
| 306 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 20 | 0 | 0 | 0 |
| 307 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 |
| 308 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 |
| 309 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 |
| 310 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| 311 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| 312 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 |
| 313 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 0 |
| 314 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 |
| 315 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 |
| 316 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 |
| 317 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 |
| 318 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 |
| 319 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 |
| 320 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 |
| 321 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 |
| 322 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 |
| 323 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 |
| 324 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 0 |
| 325 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 |
| 326 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 |
| 327 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 1 | 0 | 0 |

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TABLE 3-1 (Continued)

| Item No. | Tests AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 328 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 2 | 0 | 0 |
| 329 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 3 | 0 | 0 |
| 330 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 4 | 0 | 0 |
| 331 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 5 | 0 | 0 |
| 332 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 6 | 0 | 0 |
| 333 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 7 | 0 | 0 |
| 334 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 8 | 0 | 0 |
| 335 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 9 | 0 | 0 |
| 336 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 10 | 0 | 0 |
| 337 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 11 | 0 | 0 |
| 338 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 12 | 0 | 0 |
| 339 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 13 | 0 | 0 |
| 340 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 14 | 0 | 0 |
| 341 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 15 | 0 | 0 |
| 342 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 16 | 0 | 0 |
| 343 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 17 | 0 | 0 |
| 344 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 18 | 0 | 0 |
| 345 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 19 | 0 | 0 |
| 346 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 20 | 0 | 0 |
| 347 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 348 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 349 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 350 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 351 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 352 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 353 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 354 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 355 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 356 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 357 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 358 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 359 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 360 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 361 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 |
| 362 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 |
| 363 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 |
| 364 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 |
| 365 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 |
| 366 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 |
| 367 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 |
| 368 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 |
| 369 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 |
| 370 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 |
| 371 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 |
| 372 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 |
| 373 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 |
| 374 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 |
| 375 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 |
| 376 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 |
| 377 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 0 |
| 378 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 |
| 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 |
| 380 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 |
| 381 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 1 | 0 |
| 382 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 2 | 0 |
| 383 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 3 | 0 |
| 384 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 4 | 0 |
| 385 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 5 | 0 |
| 386 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 6 | 0 |
| 387 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 7 | 0 |
| 388 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 8 | 0 |
| 389 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 9 | 0 |
| 390 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 10 | 0 |
| 391 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 11 | 0 |
| 392 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 12 | 0 |
| 393 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 13 | 0 |

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TABLE 3-1 (Continued)

| Item No. | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 394 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 14 | 0 |
| 395 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 15 | 0 |
| 396 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 16 | 0 |
| 397 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 17 | 0 |
| 398 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 18 | 0 |
| 399 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 19 | 0 |
| 400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 20 | 0 |
| 401 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 |
| 402 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 |
| 403 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 |
| 404 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 |
| 405 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| 406 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 |
| 407 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 |
| 408 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 |
| 409 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 |
| 410 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 |
| 411 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 |
| 412 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 |
| 413 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 |
| 414 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 |
| 415 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 |
| 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 417 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 |
| 418 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 |
| 419 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 |
| 420 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 |
| 421 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 1 |
| 422 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 2 |
| 423 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 3 |
| 424 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 4 |
| 425 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 5 |
| 426 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 6 |
| 427 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 7 |
| 428 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 8 |
| 429 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 9 |
| 430 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 10 |
| 431 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 11 |
| 432 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 12 |
| 433 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 13 |
| 434 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 14 |
| 435 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 15 |
| 436 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 16 |
| 437 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 17 |
| 438 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 18 |
| 439 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 19 |
| 440 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 20 |
| 441 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| 442 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 443 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| 444 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 445 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| 446 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 447 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 448 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 449 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| 450 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 451 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 452 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 453 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| 454 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| 455 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 456 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 457 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| 458 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 459 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |

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TABLE 3-1 (Continued)

| Item No. | Tests | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AP1 | AP2 | A1 | A2 | A3 | A4 | A5 | A6 | J1 | J2 | S1 | S2 | U2 |
| 460 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 461 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| 462 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 |
| 463 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 |
| 464 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 |
| 465 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 |
| 466 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| 467 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| 468 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 469 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 470 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 471 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| 472 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 |
| 473 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| 474 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| 475 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 476 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| 477 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| 478 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 479 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 480 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | |
|---|---|
| Test A5: | 599 fifth graders in elementary schools |
| Test A6: | 412 sixth graders in elementary schools |
| Test J1: | 614 first graders in junior high schools |
| Test J2: | 758 third graders in junior high schools |

For convenience, hereafter, we shall call these groups of examinees and their performances A5/0599 Case, A6/0412 Case, J1/0614 Case and J2/0758 Case, respectively. There are also 461 second graders in junior high school who took Test J1 in Shiba's original data. In order to increase the number of examinees, this group of 461 subjects and their performances were added to the J1/0614 Case, to provide us with the J1/1075 Case. This case was further joined by an additional group of 1,184 students of four different junior high schools in Tokyo, to whom Test J1 was administered in some other research of Shiba's. We shall call this largest group of examinees and their performances J1/2259 Case. Thus we have six cases in total, with three of them partly overlapping.

When the item parameter estimation was made by Logist 5, in some cases two or more tests and the corresponding samples of examinees were combined, in order to increase the number of test items and hence to improve the accuracy of estimation. Table 3-2 presents the resulting combinations of tests and the numbers of examinees, as well as other additional information. Since there are overlapping test items between two adjacent tests, such as Tests A5 and A6, for example, the total number of items is less than the sum of the numbers of items in the separate tests, when two or more tests are combined. As for the numbers of examinees, in all the combined cases they are the direct sums of the separate cases. Thus when Tests A5 and A6 are

## TABLE 3-2

Tests, Numbers of Items, Numbers of Examinees And Other Information for Thirteen Different Cases.

| Method | Test(s) | No. of Examinees | Original No. of Items | Excluded Items | No. of Items Included |
|---|---|---|---|---|---|
| Tetrachoric Method (Shiba) | A5 | 599 | 48 | 3,13,17 | 45 |
| | A6 | 412 | 56 | -- | 56 |
| | J1 | 614 | 56 | 38 | 55 |
| | J2 | 758 | 60 | 2 | 59 |
| Tetrachoric Method (Samejima) | J1 | 1,074 | 56 | 38 | 55 |
| | J1 | 2,259 | 56 | 38 | 55 |
| Logist 5 0.0 | A5,A6 | 1,011 | 88 | -- | 88 |
| 0.0 | J1,J2 | 1,833 | 96 | -- | 96 |
| $c_g$: 0.0 | A5,A6,J1,J2 | 2,844 | 168 | -- | 168 |
| 0.0 | J1 | 1,075 | 56 | 38 | 55 |
| free | J1 | 1,075 | 56 | 38 | 55 |
| 0.0 | J1 | 2,259 | 56 | 38 | 55 |
| free | J1 | 2,259 | 56 | 38 | 55 |

combined, the 1,011 examinees are the sum of the two subject groups of 599 and 412 examinees in the A5/0599 and A6/412 Cases; when Tests J1 and J2 are combined, the 1,833 examinees are the sum of the two subject groups of 1,075 and 758 examinees in the J1/1075 and J2/758 Cases; and, when Tests A5, A6, J1 and J2 are combined, the 2,844 subjects are the sum of the four subject groups of 599, 412, 1,075 and 758 examinees in the A5/599, A6/412, J1/1075 and J2/758 Cases.

## IV. Tetrachoric Method

It has been observed that, when the group of subjects is an unselected sample from, say, an age group of subjects, in a certain geographical area, normal assumption tends to fit well for the joint distribution of response tendencies (e.g., Samejima, ONR/RR-84-1). Thus we can use the (nxn) tetrachoric correlation matrix based upon the response tendencies behind the $n$ test items and factor analyze the result to confirm the unidimensionality of the underlying latent trait. If it is confirmed, then the estimates of the item discrimination and item difficulty parameters, $a_g$ and $b_g$, in the normal ogive model will be given by

$$(4.1) \qquad \hat{a}_g = \rho_g(1-\rho_g^2)^{-1/2}$$

and

$$(4.2) \qquad \hat{b}_g = \hat{\gamma}_g \rho_g^{-1} \quad ,$$

where $\rho_g$ is the factor loading of item $g$ on the first common factor and $\hat{\gamma}_g$ is the normal deviate corresponding to the proportion-correct $\hat{p}_g$ of item g , or we can write

$$(4.3) \qquad \hat{\gamma}_g = \Phi^{-1}(1-\hat{p}_g)$$

with $\Phi^{-1}$ representing the inverse function of the standard normal distribution function.

For brevity, we shall call this method for estimating the item parameters $a_g$ and $b_g$ in the normal ogive model Tetrachoric Method. It has been shown (Samejima, ONR/RR-84-1) that this method can be used in selecting Old Test items in the non-parametric estimation of the operating characteristics, with additional procedures for validating the normal assumption and so forth.

## V. Estimated Item Parameters Based upon the Tetrachoric Method

In his original research (Shiba, 1978) Shiba used the Tetrachoric Method in estimating the item parameters. Tables 5-1 through 5-4 present the estimated item parameters of each test item of Tests A5, A6, J1 and J2 obtained by Shiba. Those values were based upon the four separate scales of $\theta$ , whose origins and units are adjusted to the means and standard deviations of the separate ability distributions of the A5/0599, A6/0412, J1/0614 and J2/0758 Cases, respectively. In these tables and throughout the rest of the paper, in order to avoid confusion, each item number is preceded by the name of the test. Thus item A501 indicates item 1 of Test A5, item A604

TABLE 5-1

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)**

| Item g | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.643 | -1.737 |
| A502 | 0.467 | -2.882 |
| A503 | --- | --- |
| A504 | 0.571 | -1.412 |
| A505 | 0.664 | -1.881 |
| A506 | 0.437 | -1.349 |
| A507 | 0.424 | -0.077 |
| A508 | 0.683 | -1.135 |
| A509 | 1.061 | -1.360 |
| A510 | 0.593 | -0.020 |
| A511 | 0.461 | -1.481 |
| A512 | 0.594 | -1.273 |
| A513 | --- | --- |
| A514 | 0.777 | -1.190 |
| A515 | 0.450 | -1.682 |
| A516 | 0.380 | 1.830 |
| A517 | --- | --- |
| A518 | 0.339 | -1.995 |
| A519 | 0.639 | -1.282 |
| A520 | 0.350 | -2.636 |
| A521 | 0.569 | -1.275 |
| A522 | 0.444 | 0.296 |
| A523 | 0.075 ▲ | 7.376 ▲ |
| A524 | 0.392 | -1.451 |
| A525 | 0.810 | -1.398 |
| A526 | 0.777 | 0.130 |
| A527 | 0.076 ▲ | 0.925 |
| A528 | 0.416 | 1.015 |
| A529 | 0.494 | 0.429 |
| A530 | 0.543 | -1.069 |
| A531 | -0.050 ▲ | -26.476 ▲ |
| A532 | 0.477 | 1.184 |
| A533 | 0.686 | -1.096 |
| A534 | 0.791 | -1.467 |
| A535 | 0.520 | -0.520 |
| A536 | 0.656 | -0.146 |
| A537 | 0.468 | -0.755 |
| A538 | 0.930 | 0.103 |
| A539 | 0.658 | -0.146 |
| A540 | 0.378 | 0.226 |
| A541 | 0.547 | -0.042 |
| A542 | 0.436 | -0.675 |
| A543 | 0.555 | -0.619 |
| A544 | 0.755 | 0.780 |
| A545 | 0.709 | 0.346 |
| A546 | 0.218 | 2.068 |
| A547 | 0.289 | 0.505 |
| A548 | 0.416 | 1.015 |

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TABLE 5-2

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

| Item g | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.664 | -1.862 |
| A602 | 0.517 | -2.699 |
| A603 | 0.776 | -1.028 |
| A604 | 0.581 | -1.115 |
| A605 | 0.596 | -0.664 |
| A606 | 1.143 | -0.877 |
| A607 | 0.745 | -0.653 |
| A608 | 0.564 | -0.204 |
| A609 | 0.558 | -0.431 |
| A610 | 0.492 | -1.132 |
| A611 | 0.660 | -0.200 |
| A612 | 0.794 | -0.466 |
| A613 | 1.085 | -0.272 |
| A614 | 0.519 | 0.564 |
| A615 | 0.310 | 0.067 |
| A616 | 0.570 | 0.242 |
| A617 | 0.818 | -1.422 |
| A618 | 0.499 | -0.919 |
| A619 | 0.561 | -0.920 |
| A620 | 0.925 | -0.206 |
| A621 | 0.803 | -0.639 |
| A622 | 0.546 | -1.524 |
| A623 | 0.452 | -1.238 |
| A624 | 0.552 | -2.028 |
| A625 | 0.402 | -1.607 |
| A626 | 0.508 | -0.728 |
| A627 | 0.325 | -0.097 |
| A628 | 0.215 | -2.900 |
| A629 | 0.626 | -0.264 |
| A630 | 0.631 | -0.656 |
| A631 | 0.591 | -0.491 |
| A632 | 0.597 | -1.189 |
| A633 | 0.383 | -0.894 |
| A634 | 0.923 | -1.504 |
| A635 | 0.707 | -2.217 |
| A636 | 0.635 | -1.455 |
| A637 | 0.475 | -0.816 |
| A638 | 0.421 | 1.341 |
| A639 | 0.034▲ | 22.634▲ |
| A640 | 0.561 | 0.245 |
| A641 | 0.628 | 0.564 |
| A642 | 0.673 | -0.967 |
| A643 | 0.707 | -0.520 |
| A644 | 1.132 | -0.040 |
| A645 | 0.472 | 0.117 |
| A646 | 0.501 | -0.447 |
| A647 | 0.566 | 0.792 |
| A648 | 0.733 | -1.590 |
| A649 | 0.458 | -0.432 |
| A650 | 0.579 | 0.040 |
| A651 | 0.611 | -0.595 |
| A652 | 0.281 | -0.740 |
| A653 | 0.572 | -0.363 |
| A654 | 0.232 | 2.918 |
| A655 | 0.838 | -0.031 |
| A656 | 0.498 | -1.099 |

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TABLE 5-3

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

| Item g | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.668 | 0.072 |
| J102 | 0.599 | -0.817 |
| J103 | 0.664 | -1.013 |
| J104 | 0.727 | -0.799 |
| J105 | 0.686 | -0.301 |
| J106 | 0.475 | -0.815 |
| J107 | 0.497 | 0.090 |
| J108 | 0.809 | -2.051 |
| J109 | 0.470 | -1.011 |
| J110 | 0.678 | -0.517 |
| J111 | 0.901 | -1.329 |
| J112 | 0.521 | -0.714 |
| J113 | 0.553 | -0.930 |
| J114 | 0.513 | 0.657 |
| J115 | 0.767 | -0.279 |
| J116 | 0.406 | -1.117 |
| J117 | 0.390 | -0.880 |
| J118 | 0.594 | -0.959 |
| J119 | 0.659 | -0.926 |
| J120 | 0.191 | 2.502 |
| J121 | 0.482 | -0.967 |
| J122 | 0.524 | -0.819 |
| J123 | 0.552 | 0.103 |
| J124 | 0.560 | -1.863 |
| J125 | 0.567 | -1.541 |
| J126 | 0.383 | -0.727 |
| J127 | 0.531 | -1.643 |
| J128 | 0.630 | -1.144 |
| J129 | 0.812 | 1.174 |
| J130 | 0.379 | -1.805 |
| J131 | 0.905 | -0.447 |
| J132 | 0.454 | 0.0 |
| J133 | 0.614 | -1.873 |
| J134 | 0.287 | 2.244 |
| J135 | 0.819 | -0.205 |
| J136 | 0.371 | 0.374 |
| J137 | 0.580 | 0.0 |
| J138 | --- | --- |
| J139 | 0.362 | 1.321 |
| J140 | 0.403 | 0.107 |
| J141 | 0.549 | -0.894 |
| J142 | 0.400 | 0.566 |
| J143 | 0.620 | -0.190 |
| J144 | 0.452 | -0.510 |
| J145 | 0.798 | -0.401 |
| J146 | 0.727 | -0.051 |
| J147 | 0.267 | 1.125 |
| J148 | 0.542 | 0.231 |
| J149 | 0.499 | -0.224 |
| J150 | 0.524 | -0.237 |
| J151 | 0.424 | 0.999 |
| J152 | 0.309 | 0.847 |
| J153 | 0.438 | 1.696 |
| J154 | 0.100 | 5.150▲ |
| J155 | 0.569 | 1.536 |
| J156 | 0.630 | 1.313 |

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## TABLE 5-4

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

| Item g | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.607 | -1.485 |
| J202 | --- | --- |
| J203 | 0.517 | 0.327 |
| J204 | 0.374 | -0.941 |
| J205 | 0.526 | -2.126 |
| J206 | 0.557 | -0.904 |
| J207 | 0.754 | -1.329 |
| J208 | 0.415 | -2.009 |
| J209 | 0.859 | -0.936 |
| J210 | 0.609 | -1.883 |
| J211 | 0.681 | -0.906 |
| J212 | 0.671 | -1.041 |
| J213 | 0.593 | -1.079 |
| J214 | 0.596 | -0.899 |
| J215 | 0.937 | -0.263 |
| J216 | 0.662 | -0.598 |
| J217 | 0.515 | 0.262 |
| J218 | 0.685 | -0.106 |
| J219 | 1.008 | -0.310 |
| J220 | 1.174 | 0.131 |
| J221 | 0.450 | 0.341 |
| J222 | 0.721 | -0.650 |
| J223 | 0.462 | -1.551 |
| J224 | 0.697 | -0.682 |
| J225 | 0.689 | -1.234 |
| J226 | 0.688 | -0.653 |
| J227 | 0.663 | -0.995 |
| J228 | 0.667 | -1.387 |
| J229 | 0.653 | -1.098 |
| J230 | 0.603 | -1.065 |
| J231 | 1.195 | -1.213 |
| J232 | 0.890 | -1.309 |
| J233 | 0.354 | 0.540 |
| J234 | 0.386 | 0.028 |
| J235 | 0.972 | -0.631 |
| J236 | 0.917 | -0.533 |
| J237 | 0.283 | -1.212 |
| J238 | 0.886 | 0.709 |
| J239 | 0.539 | -0.190 |
| J240 | 0.692 | 0.246 |
| J241 | 1.024 | -1.174 |
| J242 | 0.764 | -0.939 |
| J243 | 0.411 | -0.789 |
| J244 | 0.360 | -0.266 |
| J245 | 0.866 | -0.122 |
| J246 | 0.278 | 0.112 |
| J247 | 0.541 | -0.210 |
| J248 | 0.404 | -1.762 |
| J249 | 0.743 | -0.285 |
| J250 | 0.717 | -0.378 |
| J251 | 0.906 | -0.938 |
| J252 | 0.591 | -0.059 |
| J253 | 0.598 | 0.019 |
| J254 | 0.613 | -0.038 |
| J255 | 1.146 | 0.066 |
| J256 | 0.582 | 0.477 |
| J257 | 0.538 | -0.317 |
| J258 | 0.454 | 0.121 |
| J259 | 0.825 | 0.189 |
| J260 | 0.091▲ | 1.773 |

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means item 4 of Test A6, and so forth. We can see in these tables that the estimated item parameters are mostly reasonable with a few exceptions. In these tables, ▲ is attached to each of the estimated discrimination parameters which assume values less than 0.100 , and to each of the estimated difficulty parameters which exceed 3.000 in absolute value. Those items which are marked for both estimated parameters are A523, A531 and A639. We must conclude for these items that not only the information provided by them for measuring the ability in question is limited, but their estimated parameters may include substantial error. The closest to this group of items is item J154, whose estimated difficulty parameter exceeds 3.000 in absolute value and whose estimated discrimination parameter is just 0.100 . The other group consists of items A527 and J260, whose estimated discrimination parameters are small, but whose estimated difficulty parameters are reasonable. There is less problem for these two items.

For J1/1075* and J1/2259** Cases, we followed the same procedure of Tetrachoric Method independently, and obtained the corresponding results. To start with, Tables 5-5 and 5-6 present the

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* There was a mistake in the tape sent to us and one subject's response pattern (Subject No. 231 of the second grader group) was missing. Thus actually 1,074 subjects are involved in the whole process of Tetrachoric Method, as Table 3-2 indicates. In order to avoid confusions, however, we call it J1/1075 Case, instead of J1/1074.

** Since J1/2559 Case was analyzed later, the response pattern of the missing subject had been supplemented, and J1/2559 Case in the Tetrachoric Method consists of exactly 2,259 subjects.

# TABLE 5-5

Tetrachoric Correlation Matrix of the Fifty-Five Item Response Tendencies of Test J1 in the J1/1075 Case.

| | J101<br>J111<br>J121<br>J131<br>J142<br>J152 | J102<br>J112<br>J122<br>J132<br>J143<br>J153 | J103<br>J113<br>J123<br>J133<br>J144<br>J154 | J104<br>J114<br>J124<br>J134<br>J145<br>J155 | J105<br>J115<br>J125<br>J135<br>J146<br>J156 | J106<br>J116<br>J126<br>J136<br>J147 | J107<br>J117<br>J127<br>J137<br>J148 | J108<br>J118<br>J128<br>J139<br>J149 | J109<br>J119<br>J129<br>J140<br>J150 | J110<br>J120<br>J130<br>J141<br>J151 |
|---|---|---|---|---|---|---|---|---|---|---|
| J101 | 1.00000 | 0.30935 | 0.39791 | 0.33850 | 0.29904 | 0.26317 | 0.27566 | 0.30272 | 0.25337 | 0.29338 |
| | 0.43044 | 0.31305 | 0.29421 | 0.41238 | 0.41056 | 0.10827 | 0.10115 | 0.30170 | 0.24789 | 0.17085 |
| | 0.28498 | 0.26612 | 0.35337 | 0.30091 | 0.22179 | 0.29616 | 0.32307 | 0.41196 | 0.35104 | 0.17697 |
| | 0.41732 | 0.25297 | 0.27088 | 0.23282 | 0.28907 | 0.17383 | 0.33124 | 0.18293 | 0.18859 | 0.25425 |
| | 0.27917 | 0.32995 | 0.26562 | 0.33467 | 0.39184 | 0.26608 | 0.30593 | 0.22554 | 0.32048 | 0.36767 |
| | 0.20212 | 0.25670 | 0.12231 | 0.50233 | 0.40676 | | | | | |
| J102 | 0.30935 | 1.00000 | 0.31529 | 0.30305 | 0.30809 | 0.28091 | 0.25633 | 0.41906 | 0.17834 | 0.25370 |
| | 0.34997 | 0.22497 | 0.26707 | 0.27568 | 0.27853 | 0.18069 | 0.19496 | 0.25638 | 0.24492 | 0.08870 |
| | 0.27005 | 0.22062 | 0.11891 | 0.22486 | 0.23874 | 0.12534 | 0.21914 | 0.29098 | 0.20666 | 0.18690 |
| | 0.28704 | 0.17355 | 0.30148 | 0.15517 | 0.27531 | 0.09861 | 0.29579 | 0.23516 | 0.20962 | 0.25229 |
| | 0.18193 | 0.31944 | 0.14041 | 0.28241 | 0.24416 | 0.20532 | 0.21318 | 0.26038 | 0.22078 | 0.20238 |
| | 0.19437 | 0.06023 | 0.04128 | 0.13424 | 0.17818 | | | | | |
| J103 | 0.39791 | 0.31529 | 1.00000 | 0.31744 | 0.23228 | 0.26850 | 0.35556 | 0.24811 | 0.22524 | 0.35196 |
| | 0.35062 | 0.32353 | 0.22025 | 0.26182 | 0.36242 | 0.22497 | 0.22868 | 0.36420 | 0.22347 | 0.13660 |
| | 0.20870 | 0.24935 | 0.38642 | 0.26607 | 0.34852 | 0.20407 | 0.36412 | 0.40914 | 0.27403 | 0.12592 |
| | 0.33368 | 0.16632 | 0.18727 | 0.23758 | 0.33274 | 0.19019 | 0.28462 | 0.20189 | 0.18978 | 0.20981 |
| | 0.21874 | 0.25807 | 0.14719 | 0.20593 | 0.38369 | 0.16622 | 0.29989 | 0.23038 | 0.23544 | 0.21631 |
| | 0.23761 | 0.01170 | 0.08639 | 0.36941 | 0.29599 | | | | | |
| J104 | 0.33850 | 0.30305 | 0.31744 | 1.00000 | 0.41568 | 0.28443 | 0.31946 | 0.31191 | 0.25248 | 0.31245 |
| | 0.33496 | 0.25405 | 0.28219 | 0.32413 | 0.35373 | 0.19969 | 0.15717 | 0.24053 | 0.32057 | 0.12947 |
| | 0.24170 | 0.23749 | 0.29589 | 0.32421 | 0.26304 | 0.32498 | 0.23714 | 0.41057 | 0.37698 | 0.14477 |
| | 0.34746 | 0.19570 | 0.39260 | 0.12542 | 0.36065 | 0.25693 | 0.31862 | 0.22096 | 0.07251 | 0.33079 |
| | 0.25548 | 0.30614 | 0.16709 | 0.33730 | 0.43372 | 0.25675 | 0.14977 | 0.27139 | 0.20638 | 0.28149 |
| | 0.15200 | 0.25177 | 0.11713 | 0.41511 | 0.21442 | | | | | |
| J105 | 0.29904 | 0.30809 | 0.23228 | 0.41568 | 1.00000 | 0.29312 | 0.30232 | 0.44853 | 0.25363 | 0.31644 |
| | 0.47107 | 0.24694 | 0.32003 | 0.31609 | 0.36300 | 0.25139 | 0.24167 | 0.25397 | 0.33025 | 0.13519 |
| | 0.29810 | 0.27993 | 0.22910 | 0.28829 | 0.22380 | 0.32957 | 0.23853 | 0.40782 | 0.39773 | 0.27811 |
| | 0.41186 | 0.22375 | 0.40366 | 0.11593 | 0.39351 | 0.18305 | 0.34411 | 0.30141 | 0.28357 | 0.31226 |
| | 0.28904 | 0.35195 | 0.18740 | 0.37501 | 0.43003 | 0.23939 | 0.22455 | 0.21483 | 0.27306 | 0.22244 |
| | 0.08615 | 0.34016 | 0.16381 | 0.35953 | 0.32183 | | | | | |
| J106 | 0.26317 | 0.28091 | 0.26850 | 0.28443 | 0.29312 | 1.00000 | 0.21749 | 0.26835 | 0.20142 | 0.30066 |
| | 0.30290 | 0.25569 | 0.28171 | 0.15104 | 0.24364 | 0.27501 | 0.23397 | 0.15257 | 0.39619 | 0.04769 |
| | 0.16951 | 0.20257 | 0.19162 | 0.14858 | 0.27441 | 0.23606 | 0.21319 | 0.20040 | 0.23384 | 0.22951 |
| | 0.26897 | 0.18490 | 0.15530 | 0.05990 | 0.28331 | 0.15893 | 0.30218 | 0.19954 | 0.09121 | 0.20420 |
| | 0.24516 | 0.27060 | 0.08533 | 0.29660 | 0.27384 | 0.15284 | 0.09620 | 0.18966 | 0.22531 | 0.15927 |
| | 0.12626 | 0.17371 | 0.05026 | 0.26586 | 0.18373 | | | | | |

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## TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 07 | 0.27566 | 0.25633 | 0.35556 | 0.31946 | 0.30232 | 0.21749 | 1.00000 | 0.38260 | 0.16603 | 0.30616 |
| | 0.29424 | 0.10439 | 0.27734 | 0.21249 | 0.29084 | 0.15821 | 0.11978 | 0.30982 | 0.31161 | 0.11346 |
| | 0.19877 | 0.23987 | 0.23634 | 0.31750 | 0.25268 | 0.16091 | 0.33629 | 0.31408 | 0.31976 | 0.16672 |
| | 0.27793 | 0.09383 | 0.34322 | 0.09937 | 0.29201 | 0.23296 | 0.21356 | 0.15641 | 0.16495 | 0.22641 |
| | 0.20428 | 0.25931 | 0.09870 | 0.24559 | 0.37316 | 0.24477 | 0.25184 | 0.21071 | 0.20921 | 0.12110 |
| | 0.12033 | 0.23199 | 0.07357 | 0.27923 | 0.26611 | | | | | |
| 08 | 0.30272 | 0.41906 | 0.24811 | 0.31191 | 0.44853 | 0.26835 | 0.38260 | 1.00000 | 0.0 | 0.27627 |
| | 0.49299 | 0.31901 | 0.32654 | 0.31789 | 0.44662 | 0.31252 | 0.18635 | 0.11513 | 0.29577 | 0.09096 |
| | 0.27955 | 0.37888 | 0.26652 | 0.38822 | 0.41225 | 0.21464 | 0.40184 | 0.38467 | 0.38065 | 0.19478 |
| | 0.41433 | 0.25082 | 0.50813 | 0.09428 | 0.48109 | 0.28623 | 0.31035 | 0.13553 | 0.21231 | 0.33403 |
| | 0.18594 | 0.35370 | 0.17812 | 0.52473 | 0.41778 | 0.16518 | 0.28929 | 0.32300 | 0.33827 | 0.21229 |
| | 0.16262 | 0.17956 | 0.26073 | 0.27832 | 0.18057 | | | | | |
| 09 | 0.25337 | 0.17834 | 0.22524 | 0.25248 | 0.25363 | 0.20142 | 0.16603 | 0.0 | 1.00000 | 0.16851 |
| | 0.23214 | 0.15586 | 0.13365 | 0.18667 | 0.20073 | 0.13181 | 0.13657 | 0.22954 | 0.22336 | 0.09710 |
| | 0.16344 | 0.15538 | 0.11748 | 0.21577 | 0.23167 | 0.13910 | 0.11509 | 0.19003 | 0.08135 | 0.13728 |
| | 0.21000 | 0.03619 | 0.0 | 0.04800 | 0.21358 | 0.08312 | 0.05303 | 0.12973 | 0.17916 | 0.13328 |
| | 0.14266 | 0.14281 | 0.17360 | 0.19348 | 0.18594 | 0.10596 | 0.13237 | 0.20065 | 0.21071 | 0.12203 |
| | 0.09904 | 0.06880 | 0.0 | 0.07630 | 0.21518 | | | | | |
| 0 | 0.29338 | 0.25370 | 0.35196 | 0.31245 | 0.31644 | 0.30066 | 0.30616 | 0.27627 | 0.16851 | 1.00000 |
| | 0.38309 | 0.14885 | 0.20979 | 0.22535 | 0.33430 | 0.11796 | 0.24586 | 0.24232 | 0.27613 | 0.07026 |
| | 0.21413 | 0.30197 | 0.28361 | 0.17672 | 0.25418 | 0.24969 | 0.19251 | 0.30240 | 0.40160 | 0.26607 |
| | 0.35462 | 0.11064 | 0.33105 | 0.10775 | 0.40160 | 0.07856 | 0.30840 | 0.27039 | 0.23907 | 0.47275 |
| | 0.24825 | 0.30468 | 0.23106 | 0.28809 | 0.48460 | 0.08262 | 0.24220 | 0.25461 | 0.25399 | 0.06866 |
| | 0.08803 | 0.34082 | 0.0 | 0.31906 | 0.26012 | | | | | |
| 1 | 0.43044 | 0.34997 | 0.35062 | 0.33496 | 0.47107 | 0.30290 | 0.29424 | 0.49299 | 0.23214 | 0.38309 |
| | 1.00000 | 0.29991 | 0.28153 | 0.36773 | 0.40822 | 0.22914 | 0.18871 | 0.38888 | 0.36003 | 0.20238 |
| | 0.30082 | 0.43076 | 0.29071 | 0.39165 | 0.27795 | 0.34872 | 0.38708 | 0.49329 | 0.33595 | 0.26235 |
| | 0.41930 | 0.26165 | 0.49849 | 0.19446 | 0.46664 | 0.28752 | 0.40033 | 0.13212 | 0.29698 | 0.40603 |
| | 0.26097 | 0.39801 | 0.25324 | 0.44287 | 0.44083 | 0.22931 | 0.27728 | 0.33430 | 0.30632 | 0.43459 |
| | 0.18757 | 0.23415 | 0.09266 | 0.35113 | 0.34134 | | | | | |
| 12 | 0.31305 | 0.22497 | 0.32353 | 0.25405 | 0.24694 | 0.25569 | 0.10439 | 0.31901 | 0.15586 | 0.14885 |
| | 0.29991 | 1.00000 | 0.25967 | 0.30566 | 0.28159 | 0.04621 | 0.13193 | 0.22898 | 0.26138 | 0.09441 |
| | 0.16739 | 0.20785 | 0.12542 | 0.26464 | 0.24627 | 0.12038 | 0.21514 | 0.27918 | 0.18720 | 0.13179 |
| | 0.35070 | 0.25021 | 0.31648 | 0.07637 | 0.19771 | 0.24680 | 0.25671 | 0.11048 | 0.06551 | 0.17846 |
| | 0.13927 | 0.24174 | 0.05547 | 0.31002 | 0.30341 | 0.23901 | 0.24748 | 0.14965 | 0.18757 | 0.24104 |
| | 0.18194 | 0.03851 | 0.06170 | 0.23069 | 0.21416 | | | | | |
| 13 | 0.29421 | 0.26707 | 0.22025 | 0.28219 | 0.32003 | 0.28171 | 0.27734 | 0.32654 | 0.13365 | 0.20979 |
| | 0.28153 | 0.25967 | 1.00000 | 0.25795 | 0.26050 | 0.15725 | 0.19161 | 0.29228 | 0.33101 | 0.16131 |
| | 0.24081 | 0.22810 | 0.24109 | 0.18516 | 0.24314 | 0.18226 | 0.30674 | 0.25529 | 0.27674 | 0.13231 |
| | 0.30175 | 0.20846 | 0.40697 | 0.02516 | 0.26512 | 0.21186 | 0.19518 | 0.23792 | 0.15038 | 0.22889 |
| | 0.29100 | 0.25837 | 0.16765 | 0.28232 | 0.30251 | 0.20407 | 0.17571 | 0.12247 | 0.23164 | 0.25050 |
| | 0.17049 | 0.16488 | 0.17977 | 0.16743 | 0.27629 | | | | | |

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## TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J114 | 0.41238 | 0.27568 | 0.26182 | 0.32413 | 0.31609 | 0.15104 | 0.21249 | 0.31789 | 0.18667 | 0.22535 |
| | 0.36773 | 0.30566 | 0.25795 | 1.00000 | 0.25201 | 0.12669 | 0.12049 | 0.22405 | 0.22895 | 0.26300 |
| | 0.20900 | 0.25027 | 0.24000 | 0.16640 | 0.20463 | 0.23341 | 0.17402 | 0.31990 | 0.29481 | 0.24748 |
| | 0.30209 | 0.24225 | 0.31348 | 0.12856 | 0.31632 | 0.19414 | 0.29328 | 0.20463 | 0.27386 | 0.30927 |
| | 0.24276 | 0.31651 | 0.19093 | 0.34786 | 0.30765 | 0.35264 | 0.23146 | 0.30502 | 0.18155 | 0.32716 |
| | 0.25815 | 0.27287 | 0.11674 | 0.43397 | 0.29570 | | | | | |
| J115 | 0.41056 | 0.27853 | 0.36242 | 0.35373 | 0.36300 | 0.24364 | 0.29084 | 0.44662 | 0.20073 | 0.33430 |
| | 0.40822 | 0.28159 | 0.26050 | 0.25201 | 1.00000 | 0.23207 | 0.14414 | 0.31233 | 0.37859 | 0.23641 |
| | 0.27262 | 0.28667 | 0.23220 | 0.34088 | 0.33131 | 0.26488 | 0.27878 | 0.39831 | 0.36745 | 0.09161 |
| | 0.48375 | 0.25818 | 0.34083 | 0.17634 | 0.39278 | 0.30622 | 0.33913 | 0.25121 | 0.22415 | 0.16826 |
| | 0.31950 | 0.37187 | 0.25396 | 0.44173 | 0.40959 | 0.27163 | 0.34450 | 0.24546 | 0.30429 | 0.18044 |
| | 0.18849 | 0.30033 | 0.07258 | 0.43746 | 0.41451 | | | | | |
| J116 | 0.10827 | 0.18069 | 0.22497 | 0.19969 | 0.25139 | 0.27501 | 0.15821 | 0.31252 | 0.13181 | 0.11796 |
| | 0.22914 | 0.04621 | 0.15725 | 0.12669 | 0.23207 | 1.00000 | 0.11860 | 0.13189 | 0.23529 | 0.04060 |
| | 0.18672 | 0.11207 | 0.13342 | 0.24163 | 0.26362 | 0.08019 | 0.24244 | 0.21516 | 0.20270 | 0.10930 |
| | 0.26710 | 0.08330 | 0.26611 | 0.10992 | 0.27696 | 0.10473 | 0.21302 | 0.17758 | 0.14707 | 0.14980 |
| | 0.11258 | 0.19660 | 0.10674 | 0.21925 | 0.16172 | 0.13088 | 0.14985 | 0.19200 | 0.19294 | 0.10141 |
| | 0.18229 | 0.12980 | 0.15552 | 0.21411 | 0.19530 | | | | | |
| J117 | 0.10115 | 0.19496 | 0.22868 | 0.15717 | 0.24167 | 0.23397 | 0.11978 | 0.18635 | 0.13657 | 0.24586 |
| | 0.18871 | 0.13193 | 0.19161 | 0.12049 | 0.14414 | 0.11860 | 1.00000 | 0.18826 | 0.18962 | 0.11998 |
| | 0.12712 | 0.13011 | 0.11742 | 0.18282 | 0.11691 | 0.15937 | 0.21105 | 0.17364 | 0.30674 | 0.22992 |
| | 0.12704 | 0.10844 | 0.21720 | 0.0 | 0.30891 | 0.11122 | 0.19984 | 0.12894 | 0.14145 | 0.28267 |
| | 0.17888 | 0.25571 | 0.0 | 0.15746 | 0.19496 | 0.12059 | 0.10234 | 0.0 | 0.11314 | 0.13800 |
| | 0.10813 | 0.18436 | 0.08196 | 0.21085 | 0.19123 | | | | | |
| J118 | 0.30170 | 0.25638 | 0.36420 | 0.24053 | 0.25397 | 0.15257 | 0.30982 | 0.11513 | 0.22954 | 0.24232 |
| | 0.38888 | 0.22898 | 0.29228 | 0.22405 | 0.31233 | 0.13189 | 0.18826 | 1.00000 | 0.27544 | 0.08921 |
| | 0.23684 | 0.33980 | 0.21378 | 0.23396 | 0.30673 | 0.16281 | 0.24064 | 0.28650 | 0.38464 | 0.02964 |
| | 0.30395 | 0.17216 | 0.17289 | 0.19595 | 0.31104 | 0.19374 | 0.16917 | 0.23352 | 0.25404 | 0.12875 |
| | 0.10940 | 0.26088 | 0.17997 | 0.21836 | 0.34895 | 0.32409 | 0.25626 | 0.19178 | 0.24842 | 0.21098 |
| | 0.15902 | 0.14186 | 0.08743 | 0.27590 | 0.36816 | | | | | |
| J119 | 0.24789 | 0.24492 | 0.22347 | 0.32057 | 0.33025 | 0.39619 | 0.31161 | 0.29577 | 0.22336 | 0.27613 |
| | 0.36003 | 0.26138 | 0.33101 | 0.22895 | 0.37859 | 0.23529 | 0.18962 | 0.27544 | 1.00000 | 0.23252 |
| | 0.28653 | 0.17217 | 0.25665 | 0.37190 | 0.30620 | 0.20337 | 0.29188 | 0.21332 | 0.31360 | 0.06720 |
| | 0.42308 | 0.23837 | 0.29082 | 0.10755 | 0.33296 | 0.24604 | 0.31133 | 0.15932 | 0.11782 | 0.17648 |
| | 0.22932 | 0.19532 | 0.14077 | 0.29063 | 0.36530 | 0.18769 | 0.19785 | 0.23773 | 0.19248 | 0.28582 |
| | 0.15998 | 0.18978 | 0.04783 | 0.27007 | 0.24341 | | | | | |
| J120 | 0.17085 | 0.08870 | 0.13660 | 0.12947 | 0.13519 | 0.04769 | 0.11346 | 0.09096 | 0.09710 | 0.07026 |
| | 0.20238 | 0.09441 | 0.16131 | 0.26300 | 0.23641 | 0.04060 | 0.11998 | 0.08921 | 0.23252 | 1.00000 |
| | 0.08053 | 0.16036 | 0.16185 | 0.13704 | 0.08067 | 0.14804 | 0.09082 | 0.19324 | 0.11827 | 0.12574 |
| | 0.24059 | 0.12506 | 0.12040 | 0.05850 | 0.16674 | 0.16257 | 0.16859 | 0.09278 | 0.05089 | 0.13705 |
| | 0.20136 | 0.14277 | 0.15085 | 0.27529 | 0.15007 | 0.25652 | 0.10441 | 0.08644 | 0.09640 | 0.11600 |
| | 0.10345 | 0.17493 | 0.12505 | 0.24404 | 0.16602 | | | | | |

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## TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J121 | 0.28498 | 0.27005 | 0.20870 | 0.24170 | 0.29810 | 0.16951 | 0.19877 | 0.27955 | 0.16344 | 0.21413 |
| | 0.30082 | 0.16739 | 0.24081 | 0.20900 | 0.27262 | 0.18672 | 0.12712 | 0.23684 | 0.28653 | 0.08053 |
| | 1.00000 | 0.16315 | 0.23029 | 0.26220 | 0.15035 | 0.18275 | 0.24781 | 0.28103 | 0.31836 | 0.21538 |
| | 0.33018 | 0.16696 | 0.22443 | 0.12711 | 0.31063 | 0.18217 | 0.28844 | 0.18951 | 0.20917 | 0.21694 |
| | 0.20422 | 0.24092 | 0.16639 | 0.27236 | 0.27273 | 0.13178 | 0.17717 | 0.24030 | 0.19672 | 0.14877 |
| | 0.06747 | 0.16582 | 0.06697 | 0.23594 | 0.26813 | | | | | |
| J122 | 0.26612 | 0.22062 | 0.24935 | 0.23749 | 0.27993 | 0.20257 | 0.23987 | 0.37888 | 0.15538 | 0.30197 |
| | 0.43076 | 0.20785 | 0.22810 | 0.25027 | 0.28667 | 0.11207 | 0.13011 | 0.33980 | 0.17217 | 0.16036 |
| | 0.16315 | 1.00000 | 0.31542 | 0.18708 | 0.24764 | 0.16124 | 0.22901 | 0.30502 | 0.25241 | 0.16497 |
| | 0.33690 | 0.23653 | 0.19648 | 0.18533 | 0.27791 | 0.13804 | 0.15961 | 0.07297 | 0.20442 | 0.24402 |
| | 0.26922 | 0.22600 | 0.12912 | 0.24162 | 0.25421 | 0.25323 | 0.14632 | 0.23717 | 0.23780 | 0.18704 |
| | 0.10887 | 0.23427 | 0.09686 | 0.25734 | 0.31274 | | | | | |
| J123 | 0.35337 | 0.11891 | 0.38642 | 0.29589 | 0.22910 | 0.19162 | 0.23634 | 0.26652 | 0.11748 | 0.28361 |
| | 0.29071 | 0.12542 | 0.24109 | 0.24000 | 0.23220 | 0.13342 | 0.11742 | 0.21378 | 0.25665 | 0.16185 |
| | 0.23029 | 0.31542 | 1.00000 | 0.18699 | 0.21319 | 0.17147 | 0.25460 | 0.20743 | 0.23943 | 0.10428 |
| | 0.37902 | 0.17790 | 0.25676 | 0.12443 | 0.32410 | 0.19918 | 0.29377 | 0.17196 | 0.19042 | 0.19163 |
| | 0.14763 | 0.31843 | 0.18704 | 0.25148 | 0.29052 | 0.05023 | 0.25889 | 0.26025 | 0.26611 | 0.27407 |
| | 0.08067 | 0.13627 | 0.10811 | 0.35223 | 0.23526 | | | | | |
| J124 | 0.30091 | 0.22486 | 0.26607 | 0.32421 | 0.28829 | 0.14858 | 0.31750 | 0.38822 | 0.21577 | 0.17672 |
| | 0.39165 | 0.26464 | 0.18516 | 0.16640 | 0.34088 | 0.24163 | 0.18282 | 0.23396 | 0.37190 | 0.13704 |
| | 0.26220 | 0.18708 | 0.18699 | 1.00000 | 0.24912 | 0.17315 | 0.38256 | 0.29780 | 0.27273 | 0.10787 |
| | 0.36782 | 0.12931 | 0.25786 | 0.12702 | 0.37952 | 0.17814 | 0.28660 | 0.16791 | 0.14685 | 0.15302 |
| | 0.13448 | 0.20623 | 0.14264 | 0.31250 | 0.32517 | 0.17498 | 0.21897 | 0.27252 | 0.23735 | 0.10116 |
| | 0.16224 | 0.16067 | 0.10620 | 0.34328 | 0.31917 | | | | | |
| J125 | 0.22179 | 0.23874 | 0.34852 | 0.26304 | 0.22380 | 0.27441 | 0.25268 | 0.41225 | 0.23167 | 0.25418 |
| | 0.27795 | 0.24627 | 0.24314 | 0.20463 | 0.33131 | 0.26362 | 0.11691 | 0.30673 | 0.30620 | 0.08067 |
| | 0.15035 | 0.24764 | 0.21319 | 0.24912 | 1.00000 | 0.25568 | 0.23704 | 0.32566 | 0.28133 | 0.16237 |
| | 0.33207 | 0.17050 | 0.24042 | 0.05517 | 0.27483 | 0.05356 | 0.22476 | 0.13477 | 0.05230 | 0.20652 |
| | 0.15476 | 0.26353 | 0.14157 | 0.30395 | 0.34034 | 0.15559 | 0.21559 | 0.20316 | 0.16642 | 0.07089 |
| | 0.06878 | 0.05966 | 0.0 | 0.31466 | 0.13016 | | | | | |
| J126 | 0.29616 | 0.12534 | 0.20407 | 0.32498 | 0.32957 | 0.23606 | 0.16091 | 0.21464 | 0.13910 | 0.24969 |
| | 0.34872 | 0.12038 | 0.18226 | 0.23341 | 0.26488 | 0.08019 | 0.15937 | 0.16281 | 0.20337 | 0.14804 |
| | 0.18275 | 0.16124 | 0.17147 | 0.17315 | 0.25568 | 1.00000 | 0.17831 | 0.32461 | 0.13654 | 0.16979 |
| | 0.22128 | 0.21350 | 0.28181 | 0.18210 | 0.26683 | 0.12272 | 0.24177 | 0.11369 | 0.15159 | 0.28394 |
| | 0.22407 | 0.29142 | 0.14039 | 0.23768 | 0.29413 | 0.18948 | 0.29291 | 0.17888 | 0.15677 | 0.13492 |
| | 0.09721 | 0.12393 | 0.06654 | 0.31946 | 0.24320 | | | | | |
| J127 | 0.32307 | 0.21914 | 0.36412 | 0.23714 | 0.23853 | 0.21319 | 0.33629 | 0.40184 | 0.11509 | 0.19251 |
| | 0.38708 | 0.21514 | 0.30674 | 0.17402 | 0.27878 | 0.24244 | 0.21105 | 0.24064 | 0.29188 | 0.09082 |
| | 0.24781 | 0.22901 | 0.25460 | 0.38256 | 0.23704 | 0.17831 | 1.00000 | 0.36539 | 0.24094 | 0.11410 |
| | 0.35251 | 0.13214 | 0.24431 | 0.04895 | 0.28346 | 0.21080 | 0.23678 | 0.09069 | 0.11030 | 0.14501 |
| | 0.11489 | 0.24369 | 0.12298 | 0.26189 | 0.29640 | 0.03146 | 0.30083 | 0.23553 | 0.18693 | 0.28658 |
| | 0.18112 | 0.08532 | 0.08784 | 0.30286 | 0.21967 | | | | | |

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## TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J128 | 0.41196 | 0.29098 | 0.40914 | 0.41057 | 0.40782 | 0.20040 | 0.31408 | 0.38467 | 0.19003 | 0.30240 |
| | 0.49329 | 0.27918 | 0.25529 | 0.31990 | 0.39831 | 0.21516 | 0.17364 | 0.28650 | 0.21332 | 0.19324 |
| | 0.28103 | 0.30502 | 0.20743 | 0.29780 | 0.32566 | 0.32461 | 0.36539 | 1.00000 | 0.33568 | 0.17941 |
| | 0.36509 | 0.22161 | 0.43798 | 0.21986 | 0.30675 | 0.20434 | 0.33729 | 0.17290 | 0.22646 | 0.30753 |
| | 0.22774 | 0.38867 | 0.19474 | 0.35843 | 0.43961 | 0.20824 | 0.26090 | 0.29280 | 0.29426 | 0.21415 |
| | 0.18978 | 0.18754 | 0.24010 | 0.40386 | 0.28102 | | | | | |
| J129 | 0.35104 | 0.20666 | 0.27403 | 0.37698 | 0.39773 | 0.23384 | 0.31976 | 0.38065 | 0.08135 | 0.40160 |
| | 0.33595 | 0.18720 | 0.27674 | 0.29481 | 0.36745 | 0.20270 | 0.30674 | 0.38464 | 0.31360 | 0.11827 |
| | 0.31836 | 0.25241 | 0.23943 | 0.27273 | 0.28133 | 0.13654 | 0.24094 | 0.33568 | 1.00000 | 0.17791 |
| | 0.40416 | 0.32244 | 0.43971 | 0.20242 | 0.53346 | 0.17698 | 0.38200 | 0.25604 | 0.31838 | 0.33622 |
| | 0.33108 | 0.35699 | 0.18811 | 0.37774 | 0.45545 | 0.24371 | 0.23612 | 0.19733 | 0.23116 | 0.18054 |
| | 0.21323 | 0.34251 | 0.15177 | 0.37115 | 0.43637 | | | | | |
| J130 | 0.17697 | 0.18698 | 0.12592 | 0.14477 | 0.27811 | 0.22951 | 0.16672 | 0.19478 | 0.13728 | 0.26607 |
| | 0.26235 | 0.13179 | 0.13231 | 0.24748 | 0.09161 | 0.10930 | 0.22992 | 0.02964 | 0.06720 | 0.12574 |
| | 0.21538 | 0.16497 | 0.10428 | 0.10787 | 0.16237 | 0.16979 | 0.11410 | 0.17941 | 0.17791 | 1.00000 |
| | 0.19959 | 0.06047 | 0.29090 | 0.14770 | 0.23993 | 0.10503 | 0.07932 | 0.05336 | 0.0 | 0.36474 |
| | 0.25821 | 0.19653 | 0.08775 | 0.16530 | 0.26935 | 0.0 | 0.03772 | 0.19344 | 0.08128 | 0.12169 |
| | 0.08645 | 0.24015 | 0.0 | 0.25082 | 0.21522 | | | | | |
| J131 | 0.41732 | 0.28704 | 0.33368 | 0.34746 | 0.41186 | 0.26897 | 0.27793 | 0.41433 | 0.21000 | 0.35462 |
| | 0.41930 | 0.35070 | 0.30175 | 0.30209 | 0.48375 | 0.26710 | 0.12704 | 0.30395 | 0.42308 | 0.24059 |
| | 0.33018 | 0.33690 | 0.37902 | 0.36782 | 0.33207 | 0.22128 | 0.35251 | 0.36509 | 0.40416 | 0.19959 |
| | 1.00000 | 0.28767 | 0.31298 | 0.11669 | 0.31724 | 0.23522 | 0.51583 | 0.24723 | 0.25680 | 0.21238 |
| | 0.33045 | 0.37305 | 0.24248 | 0.48575 | 0.34742 | 0.24626 | 0.33433 | 0.29190 | 0.29921 | 0.21611 |
| | 0.17739 | 0.21370 | 0.08868 | 0.46748 | 0.40727 | | | | | |
| J132 | 0.25297 | 0.17355 | 0.16632 | 0.19570 | 0.22375 | 0.18490 | 0.09383 | 0.25082 | 0.03619 | 0.11064 |
| | 0.26165 | 0.25021 | 0.20846 | 0.24225 | 0.25818 | 0.08330 | 0.10844 | 0.17216 | 0.23837 | 0.12506 |
| | 0.16696 | 0.23653 | 0.17790 | 0.12931 | 0.17050 | 0.21350 | 0.13214 | 0.22161 | 0.32244 | 0.06047 |
| | 0.28767 | 1.00000 | 0.29162 | 0.11936 | 0.20570 | 0.14899 | 0.26881 | 0.14693 | 0.14429 | 0.16775 |
| | 0.16188 | 0.26005 | 0.17745 | 0.19173 | 0.24485 | 0.24092 | 0.21727 | 0.10114 | 0.18894 | 0.24477 |
| | 0.22279 | 0.18145 | 0.06210 | 0.23397 | 0.30002 | | | | | |
| J133 | 0.27088 | 0.30148 | 0.18727 | 0.39260 | 0.40366 | 0.15530 | 0.34322 | 0.50813 | 0.0 | 0.33105 |
| | 0.49849 | 0.31648 | 0.40697 | 0.31348 | 0.34083 | 0.26611 | 0.21720 | 0.17289 | 0.29082 | 0.12040 |
| | 0.22443 | 0.19648 | 0.25676 | 0.25786 | 0.24042 | 0.28181 | 0.24431 | 0.43798 | 0.43971 | 0.29090 |
| | 0.31298 | 0.29162 | 1.00000 | 0.12500 | 0.44739 | 0.23625 | 0.23948 | 0.23528 | 0.16927 | 0.48267 |
| | 0.18399 | 0.33519 | 0.18892 | 0.33558 | 0.46961 | 0.16295 | 0.14473 | 0.27288 | 0.24671 | 0.19285 |
| | 0.06851 | 0.20207 | 0.0 | 0.36090 | 0.21570 | | | | | |
| J134 | 0.23282 | 0.15517 | 0.23758 | 0.12542 | 0.11593 | 0.05990 | 0.09937 | 0.09428 | 0.04800 | 0.10775 |
| | 0.19446 | 0.07637 | 0.02516 | 0.12856 | 0.17634 | 0.10992 | 0.0 | 0.19595 | 0.10755 | 0.05850 |
| | 0.12711 | 0.18533 | 0.12443 | 0.12702 | 0.05517 | 0.18210 | 0.04895 | 0.21986 | 0.20242 | 0.14770 |
| | 0.11669 | 0.11936 | 0.12500 | 1.00000 | 0.20540 | 0.11002 | 0.15179 | 0.15509 | 0.06275 | 0.14796 |
| | 0.14505 | 0.18624 | 0.12101 | 0.17388 | 0.19250 | 0.19270 | 0.17957 | 0.25859 | 0.14301 | 0.18425 |
| | 0.17912 | 0.20837 | 0.08320 | 0.22567 | 0.24308 | | | | | |

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TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J135 | 0.28907 | 0.27531 | 0.33274 | 0.36065 | 0.39351 | 0.28331 | 0.29201 | 0.48109 | 0.21358 | 0.40160 |
| | 0.46664 | 0.19771 | 0.26512 | 0.31632 | 0.39278 | 0.27696 | 0.30891 | 0.31104 | 0.33296 | 0.16674 |
| | 0.31063 | 0.27791 | 0.32410 | 0.37952 | 0.27483 | 0.26683 | 0.28346 | 0.30675 | 0.53346 | 0.23993 |
| | 0.31724 | 0.20570 | 0.44739 | 0.20540 | 1.00000 | 0.17023 | 0.28226 | 0.27339 | 0.21636 | 0.40200 |
| | 0.22766 | 0.41365 | 0.21571 | 0.34856 | 0.50045 | 0.19124 | 0.24477 | 0.25031 | 0.28531 | 0.24895 |
| | 0.18942 | 0.26884 | 0.19095 | 0.43382 | 0.36839 | | | | | |
| J136 | 0.17383 | 0.09861 | 0.19019 | 0.25693 | 0.18305 | 0.15893 | 0.23296 | 0.28623 | 0.08312 | 0.07856 |
| | 0.28752 | 0.24680 | 0.21186 | 0.19414 | 0.30622 | 0.10473 | 0.11122 | 0.19374 | 0.24604 | 0.16257 |
| | 0.18217 | 0.13804 | 0.19918 | 0.17814 | 0.05356 | 0.12272 | 0.21080 | 0.20434 | 0.17698 | 0.10503 |
| | 0.23522 | 0.14899 | 0.23625 | 0.11002 | 0.17023 | 1.00000 | 0.16214 | 0.09354 | 0.02874 | 0.10346 |
| | 0.21151 | 0.10625 | 0.0 | 0.17436 | 0.21114 | 0.11555 | 0.12160 | 0.16559 | 0.15373 | 0.12616 |
| | 0.12453 | 0.17790 | 0.0 | 0.26466 | 0.16850 | | | | | |
| J137 | 0.33124 | 0.29579 | 0.28462 | 0.31862 | 0.34411 | 0.30218 | 0.21356 | 0.31035 | 0.05303 | 0.30840 |
| | 0.40033 | 0.25671 | 0.19518 | 0.29328 | 0.33913 | 0.21302 | 0.19984 | 0.16917 | 0.31133 | 0.16859 |
| | 0.28844 | 0.15961 | 0.29377 | 0.28660 | 0.22476 | 0.24177 | 0.23678 | 0.33729 | 0.38200 | 0.07932 |
| | 0.51583 | 0.26881 | 0.23948 | 0.15179 | 0.28226 | 0.16214 | 1.00000 | 0.29200 | 0.28991 | 0.30807 |
| | 0.20735 | 0.38675 | 0.22786 | 0.35762 | 0.42002 | 0.25700 | 0.27690 | 0.25557 | 0.19138 | 0.22824 |
| | 0.16311 | 0.16904 | 0.19869 | 0.37773 | 0.32348 | | | | | |
| J139 | 0.18293 | 0.23516 | 0.20189 | 0.22096 | 0.30141 | 0.19954 | 0.15641 | 0.13553 | 0.12973 | 0.27039 |
| | 0.13212 | 0.11048 | 0.23792 | 0.20463 | 0.25121 | 0.17758 | 0.12894 | 0.23352 | 0.15932 | 0.09278 |
| | 0.18951 | 0.07297 | 0.17196 | 0.16791 | 0.13477 | 0.11369 | 0.09069 | 0.17290 | 0.25604 | 0.05336 |
| | 0.24723 | 0.14693 | 0.23528 | 0.15509 | 0.27339 | 0.09354 | 0.29200 | 1.00000 | 0.16917 | 0.19714 |
| | 0.13326 | 0.24042 | 0.18021 | 0.16515 | 0.21414 | 0.14516 | 0.20542 | 0.22342 | 0.15829 | 0.23366 |
| | 0.19805 | 0.24738 | 0.18187 | 0.24243 | 0.32714 | | | | | |
| J140 | 0.18859 | 0.20962 | 0.18978 | 0.07251 | 0.28357 | 0.09121 | 0.16495 | 0.21231 | 0.17916 | 0.23907 |
| | 0.29698 | 0.06551 | 0.15038 | 0.27386 | 0.22415 | 0.14707 | 0.14145 | 0.25404 | 0.11782 | 0.05089 |
| | 0.20917 | 0.20442 | 0.19042 | 0.14685 | 0.05230 | 0.15159 | 0.11030 | 0.22646 | 0.31838 | 0.0 |
| | 0.25680 | 0.14429 | 0.16927 | 0.06275 | 0.21636 | 0.02874 | 0.28991 | 0.16917 | 1.00000 | 0.11785 |
| | 0.17707 | 0.24367 | 0.64064 | 0.28476 | 0.15240 | 0.16105 | 0.21451 | 0.20129 | 0.21001 | 0.14348 |
| | 0.05209 | 0.10665 | 0.0 | 0.27834 | 0.23768 | | | | | |
| J141 | 0.25425 | 0.25229 | 0.20981 | 0.33079 | 0.31226 | 0.20420 | 0.22641 | 0.33403 | 0.13328 | 0.47275 |
| | 0.40603 | 0.17846 | 0.22889 | 0.30927 | 0.16826 | 0.14980 | 0.28267 | 0.12875 | 0.17648 | 0.13705 |
| | 0.21694 | 0.24402 | 0.19163 | 0.15302 | 0.20652 | 0.28394 | 0.14501 | 0.30753 | 0.33622 | 0.36474 |
| | 0.21238 | 0.16775 | 0.48267 | 0.14796 | 0.40200 | 0.10346 | 0.30807 | 0.19714 | 0.11785 | 1.00000 |
| | 0.32183 | 0.29720 | 0.12499 | 0.24177 | 0.37306 | 0.12547 | 0.09708 | 0.19163 | 0.20668 | 0.09747 |
| | 0.0 | 0.33495 | 0.22304 | 0.31786 | 0.25772 | | | | | |
| J142 | 0.27917 | 0.18193 | 0.21874 | 0.25548 | 0.28904 | 0.24516 | 0.20428 | 0.18594 | 0.14266 | 0.24825 |
| | 0.26097 | 0.13927 | 0.29100 | 0.24276 | 0.31950 | 0.11258 | 0.17888 | 0.10940 | 0.22932 | 0.20136 |
| | 0.20422 | 0.26922 | 0.14763 | 0.13448 | 0.15476 | 0.22407 | 0.11489 | 0.22774 | 0.33108 | 0.25821 |
| | 0.33045 | 0.16188 | 0.18399 | 0.14505 | 0.22766 | 0.21151 | 0.20735 | 0.13326 | 0.17707 | 0.32183 |
| | 1.00000 | 0.30228 | 0.10904 | 0.22830 | 0.27880 | 0.30287 | 0.18092 | 0.22037 | 0.23534 | 0.22871 |
| | 0.16394 | 0.21856 | 0.0 | 0.29906 | 0.27739 | | | | | |

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## TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J143 | 0.32995 | 0.31944 | 0.25807 | 0.30614 | 0.35195 | 0.27060 | 0.25931 | 0.35370 | 0.14281 | 0.30468 |
| | 0.39801 | 0.24174 | 0.25837 | 0.31651 | 0.37187 | 0.19660 | 0.25571 | 0.26088 | 0.19532 | 0.14277 |
| | 0.24092 | 0.22600 | 0.31843 | 0.20623 | 0.26353 | 0.29142 | 0.24369 | 0.38867 | 0.35699 | 0.19653 |
| | 0.37305 | 0.26005 | 0.33519 | 0.18624 | 0.41365 | 0.10625 | 0.38675 | 0.24042 | 0.24367 | 0.29720 |
| | 0.30228 | 1.00000 | 0.21972 | 0.38730 | 0.32319 | 0.23554 | 0.27404 | 0.24892 | 0.28685 | 0.21422 |
| | 0.22333 | 0.25101 | 0.10722 | 0.34149 | 0.35933 | | | | | |
| J144 | 0.26562 | 0.14041 | 0.14719 | 0.16709 | 0.18740 | 0.08533 | 0.09870 | 0.17812 | 0.17360 | 0.23106 |
| | 0.25324 | 0.05547 | 0.16765 | 0.19093 | 0.25396 | 0.10674 | 0.0 | 0.17997 | 0.14077 | 0.15085 |
| | 0.16639 | 0.12912 | 0.18704 | 0.14264 | 0.14157 | 0.14039 | 0.12298 | 0.19474 | 0.18811 | 0.08775 |
| | 0.24248 | 0.17745 | 0.18892 | 0.12101 | 0.21571 | 0.0 | 0.22786 | 0.18021 | 0.64064 | 0.12499 |
| | 0.10904 | 0.21972 | 1.00000 | 0.24170 | 0.18086 | 0.11818 | 0.20396 | 0.28260 | 0.21739 | 0.14854 |
| | 0.13612 | 0.20601 | 0.04427 | 0.24051 | 0.15793 | | | | | |
| J145 | 0.33467 | 0.28241 | 0.20593 | 0.33730 | 0.37501 | 0.29660 | 0.24559 | 0.52473 | 0.19348 | 0.28809 |
| | 0.44287 | 0.31002 | 0.28232 | 0.34786 | 0.44173 | 0.21925 | 0.15746 | 0.21836 | 0.29063 | 0.27529 |
| | 0.27236 | 0.24162 | 0.25148 | 0.31250 | 0.30395 | 0.23768 | 0.26189 | 0.35843 | 0.37774 | 0.16530 |
| | 0.48575 | 0.19173 | 0.33558 | 0.17388 | 0.34856 | 0.17436 | 0.35762 | 0.16515 | 0.28476 | 0.24177 |
| | 0.22830 | 0.38730 | 0.24170 | 1.00000 | 0.29924 | 0.15148 | 0.32319 | 0.41905 | 0.36531 | 0.29461 |
| | 0.25577 | 0.28920 | 0.06249 | 0.31389 | 0.39920 | | | | | |
| J146 | 0.39184 | 0.24416 | 0.38369 | 0.43372 | 0.43003 | 0.27384 | 0.37316 | 0.41778 | 0.18594 | 0.48460 |
| | 0.44083 | 0.30341 | 0.30251 | 0.30765 | 0.40959 | 0.16172 | 0.19496 | 0.34895 | 0.36530 | 0.15007 |
| | 0.27273 | 0.25421 | 0.29052 | 0.32517 | 0.34034 | 0.29413 | 0.29640 | 0.43961 | 0.45545 | 0.26935 |
| | 0.34742 | 0.24485 | 0.46961 | 0.19250 | 0.50045 | 0.21114 | 0.42002 | 0.21414 | 0.15240 | 0.37306 |
| | 0.27880 | 0.32319 | 0.18086 | 0.29924 | 1.00000 | 0.26445 | 0.26241 | 0.23249 | 0.32094 | 0.26630 |
| | 0.17889 | 0.26710 | 0.12202 | 0.39181 | 0.32767 | | | | | |
| J147 | 0.26608 | 0.20532 | 0.16622 | 0.25675 | 0.23939 | 0.15284 | 0.24477 | 0.16518 | 0.10596 | 0.08262 |
| | 0.22931 | 0.23901 | 0.20407 | 0.35264 | 0.27163 | 0.13088 | 0.12059 | 0.32409 | 0.18769 | 0.25652 |
| | 0.13178 | 0.25323 | 0.05023 | 0.17498 | 0.15559 | 0.18948 | 0.03146 | 0.20824 | 0.24371 | 0.0 |
| | 0.24626 | 0.24092 | 0.16295 | 0.19270 | 0.19124 | 0.11555 | 0.25700 | 0.14516 | 0.16105 | 0.12547 |
| | 0.30287 | 0.23554 | 0.11818 | 0.15148 | 0.26445 | 1.00000 | 0.20298 | 0.12776 | 0.14227 | 0.16507 |
| | 0.27413 | 0.19470 | 0.22060 | 0.40295 | 0.36069 | | | | | |
| J148 | 0.30593 | 0.21318 | 0.29989 | 0.14977 | 0.22455 | 0.09620 | 0.25184 | 0.28929 | 0.13237 | 0.24220 |
| | 0.27728 | 0.24748 | 0.17571 | 0.23146 | 0.34450 | 0.14985 | 0.10234 | 0.25626 | 0.19785 | 0.10441 |
| | 0.17717 | 0.14632 | 0.25889 | 0.21897 | 0.21559 | 0.29291 | 0.30083 | 0.26090 | 0.23612 | 0.03772 |
| | 0.33433 | 0.21727 | 0.14473 | 0.17957 | 0.24477 | 0.12160 | 0.27690 | 0.20542 | 0.21451 | 0.09708 |
| | 0.18092 | 0.27404 | 0.20396 | 0.32319 | 0.26241 | 0.20298 | 1.00000 | 0.20458 | 0.21693 | 0.24626 |
| | 0.15209 | 0.20964 | 0.17376 | 0.33810 | 0.33199 | | | | | |
| J149 | 0.22554 | 0.26038 | 0.23038 | 0.27139 | 0.21483 | 0.18986 | 0.21071 | 0.32300 | 0.20065 | 0.25461 |
| | 0.33430 | 0.14965 | 0.12247 | 0.30502 | 0.24546 | 0.19200 | 0.0 | 0.19178 | 0.23773 | 0.08644 |
| | 0.24030 | 0.23717 | 0.26025 | 0.27252 | 0.20316 | 0.17888 | 0.23553 | 0.29280 | 0.19733 | 0.19344 |
| | 0.29190 | 0.10114 | 0.27288 | 0.25859 | 0.25031 | 0.16559 | 0.25557 | 0.22342 | 0.20129 | 0.19163 |
| | 0.22037 | 0.24892 | 0.28260 | 0.41905 | 0.23249 | 0.12776 | 0.20458 | 1.00000 | 0.21535 | 0.11287 |
| | 0.15548 | 0.24598 | 0.10954 | 0.25488 | 0.25786 | | | | | |

## TABLE 5-5 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J150 | 0.32048 | 0.22078 | 0.23544 | 0.20638 | 0.27306 | 0.22531 | 0.20921 | 0.33827 | 0.21071 | 0.25399 |
| | 0.30632 | 0.18757 | 0.23164 | 0.18155 | 0.30429 | 0.19294 | 0.11314 | 0.24842 | 0.19248 | 0.09640 |
| | 0.19672 | 0.23780 | 0.26611 | 0.23735 | 0.16642 | 0.15677 | 0.18693 | 0.29426 | 0.23116 | 0.08128 |
| | 0.29921 | 0.18894 | 0.24671 | 0.14301 | 0.28531 | 0.15373 | 0.19138 | 0.15829 | 0.21001 | 0.20668 |
| | 0.23534 | 0.28685 | 0.21739 | 0.36531 | 0.32094 | 0.14227 | 0.21693 | 0.21535 | 1.00000 | 0.24536 |
| | 0.11369 | 0.21868 | 0.09721 | 0.28590 | 0.24682 | | | | | |
| J151 | 0.36767 | 0.20238 | 0.21631 | 0.28149 | 0.22244 | 0.15927 | 0.12110 | 0.21229 | 0.12203 | 0.06866 |
| | 0.43459 | 0.24104 | 0.25050 | 0.32716 | 0.18044 | 0.10141 | 0.13800 | 0.21098 | 0.28582 | 0.11600 |
| | 0.14877 | 0.18704 | 0.27407 | 0.10116 | 0.07089 | 0.13492 | 0.28658 | 0.21415 | 0.18054 | 0.12169 |
| | 0.21611 | 0.24477 | 0.19285 | 0.18425 | 0.24895 | 0.12616 | 0.22824 | 0.23366 | 0.14348 | 0.09747 |
| | 0.22871 | 0.21422 | 0.14854 | 0.29461 | 0.26630 | 0.16507 | 0.24626 | 0.11287 | 0.24536 | 1.00000 |
| | 0.27145 | 0.20005 | 0.09034 | 0.36964 | 0.38954 | | | | | |
| J152 | 0.20212 | 0.19437 | 0.23761 | 0.15200 | 0.08615 | 0.12626 | 0.12033 | 0.16262 | 0.09904 | 0.08803 |
| | 0.18757 | 0.18194 | 0.17049 | 0.25815 | 0.18849 | 0.18229 | 0.10813 | 0.15902 | 0.15998 | 0.10345 |
| | 0.06747 | 0.10887 | 0.08067 | 0.16224 | 0.06878 | 0.09721 | 0.18112 | 0.18978 | 0.21323 | 0.08645 |
| | 0.17739 | 0.22279 | 0.06851 | 0.17912 | 0.18942 | 0.12453 | 0.16311 | 0.19805 | 0.05209 | 0.0 |
| | 0.16394 | 0.22333 | 0.13612 | 0.25577 | 0.17889 | 0.27413 | 0.15209 | 0.15548 | 0.11369 | 0.27145 |
| | 1.00000 | 0.22674 | 0.18008 | 0.25111 | 0.25376 | | | | | |
| J153 | 0.25670 | 0.06023 | 0.01170 | 0.25177 | 0.34016 | 0.17371 | 0.23199 | 0.17956 | 0.06880 | 0.34082 |
| | 0.23415 | 0.03851 | 0.16488 | 0.27287 | 0.30033 | 0.12980 | 0.18436 | 0.14186 | 0.18978 | 0.17493 |
| | 0.16582 | 0.23427 | 0.13627 | 0.16067 | 0.05966 | 0.12393 | 0.08532 | 0.18754 | 0.34251 | 0.24015 |
| | 0.21370 | 0.18145 | 0.20207 | 0.20837 | 0.26884 | 0.17790 | 0.16904 | 0.24738 | 0.10665 | 0.33495 |
| | 0.21856 | 0.25101 | 0.20601 | 0.28920 | 0.26710 | 0.19470 | 0.20964 | 0.24598 | 0.21868 | 0.20005 |
| | 0.22674 | 1.00000 | 0.18219 | 0.34618 | 0.26838 | | | | | |
| J154 | 0.12231 | 0.04128 | 0.08639 | 0.11713 | 0.16381 | 0.05026 | 0.07357 | 0.26073 | 0.0 | 0.0 |
| | 0.09266 | 0.06170 | 0.17977 | 0.11674 | 0.07258 | 0.15552 | 0.08196 | 0.08743 | 0.04783 | 0.12505 |
| | 0.06697 | 0.09686 | 0.10811 | 0.10620 | 0.0 | 0.06654 | 0.08784 | 0.24010 | 0.15177 | 0.0 |
| | 0.08868 | 0.06210 | 0.0 | 0.08320 | 0.19095 | 0.0 | 0.19869 | 0.18187 | 0.0 | 0.22304 |
| | 0.0 | 0.10722 | 0.04427 | 0.06249 | 0.12202 | 0.22060 | 0.17376 | 0.10954 | 0.09721 | 0.09034 |
| | 0.18008 | 0.18219 | 1.00000 | 0.18318 | 0.16472 | | | | | |
| J155 | 0.50233 | 0.13424 | 0.36941 | 0.41511 | 0.35953 | 0.26586 | 0.27923 | 0.27832 | 0.07630 | 0.31906 |
| | 0.35113 | 0.23069 | 0.16743 | 0.43397 | 0.43746 | 0.21411 | 0.21085 | 0.27590 | 0.27007 | 0.24404 |
| | 0.23594 | 0.25734 | 0.35223 | 0.34328 | 0.31466 | 0.31946 | 0.30266 | 0.40386 | 0.37115 | 0.25082 |
| | 0.46748 | 0.23397 | 0.36090 | 0.22567 | 0.43382 | 0.26466 | 0.37773 | 0.24243 | 0.27834 | 0.31786 |
| | 0.29906 | 0.34149 | 0.24051 | 0.31389 | 0.39181 | 0.40295 | 0.33810 | 0.25488 | 0.28590 | 0.36964 |
| | 0.25111 | 0.34618 | 0.18318 | 1.00000 | 0.46901 | | | | | |
| J156 | 0.40676 | 0.17818 | 0.29599 | 0.21442 | 0.32183 | 0.18373 | 0.26611 | 0.18057 | 0.21518 | 0.26012 |
| | 0.34134 | 0.21416 | 0.27629 | 0.29570 | 0.41451 | 0.19530 | 0.19123 | 0.36816 | 0.24341 | 0.16602 |
| | 0.26813 | 0.31274 | 0.23526 | 0.31917 | 0.13016 | 0.24320 | 0.21967 | 0.28102 | 0.43637 | 0.21522 |
| | 0.40727 | 0.30002 | 0.21570 | 0.24308 | 0.36839 | 0.16850 | 0.32348 | 0.32714 | 0.23768 | 0.25772 |
| | 0.27739 | 0.35933 | 0.15793 | 0.39920 | 0.32767 | 0.36069 | 0.33199 | 0.25786 | 0.24682 | 0.38954 |
| | 0.25376 | 0.26838 | 0.16472 | 0.46901 | 1.00000 | | | | | |

## TABLE 5-6

Tetrachoric Correlation Matrix of the Fifty-Five Item Response Tendencies of Test J1 in the J1/2259 Case.

|  | J101<br>J111<br>J121<br>J131<br>J142<br>J152 | J102<br>J112<br>J122<br>J132<br>J143<br>J153 | J103<br>J113<br>J123<br>J133<br>J144<br>J154 | J104<br>J114<br>J124<br>J134<br>J145<br>J155 | J105<br>J115<br>J125<br>J135<br>J146<br>J156 | J106<br>J116<br>J126<br>J136<br>J147 | J107<br>J117<br>J127<br>J137<br>J148 | J108<br>J118<br>J128<br>J139<br>J149 | J109<br>J119<br>J129<br>J140<br>J150 | J110<br>J120<br>J130<br>J141<br>J151 |
|---|---|---|---|---|---|---|---|---|---|---|
| J101 | 1.00000 | 0.32878 | 0.33142 | 0.27233 | 0.36527 | 0.23930 | 0.25433 | 0.28207 | 0.25357 | 0.20154 |
|  | 0.44109 | 0.30687 | 0.25598 | 0.25899 | 0.35874 | 0.13501 | 0.16455 | 0.31979 | 0.25637 | 0.17382 |
|  | 0.26701 | 0.27938 | 0.30775 | 0.22350 | 0.21587 | 0.19550 | 0.27860 | 0.33976 | 0.34834 | 0.16264 |
|  | 0.39523 | 0.15432 | 0.29977 | 0.23934 | 0.32843 | 0.18602 | 0.30441 | 0.16192 | 0.22883 | 0.24048 |
|  | 0.20900 | 0.26363 | 0.24065 | 0.33405 | 0.36443 | 0.19770 | 0.30278 | 0.21787 | 0.27089 | 0.27333 |
|  | 0.22068 | 0.15374 | 0.08216 | 0.44011 | 0.35716 |  |  |  |  |  |
| J102 | 0.32878 | 1.00000 | 0.25744 | 0.29398 | 0.31323 | 0.27692 | 0.22315 | 0.34279 | 0.17459 | 0.21537 |
|  | 0.36948 | 0.21190 | 0.22886 | 0.16958 | 0.28203 | 0.17924 | 0.19360 | 0.31720 | 0.22714 | 0.15051 |
|  | 0.22386 | 0.17091 | 0.18226 | 0.26193 | 0.18780 | 0.14647 | 0.17569 | 0.30612 | 0.22842 | 0.15818 |
|  | 0.28004 | 0.15986 | 0.32263 | 0.15234 | 0.29703 | 0.13125 | 0.22780 | 0.19857 | 0.13798 | 0.15917 |
|  | 0.13424 | 0.25861 | 0.14061 | 0.23948 | 0.26860 | 0.11470 | 0.19364 | 0.20211 | 0.27458 | 0.20833 |
|  | 0.17808 | 0.05059 | 0.09907 | 0.17276 | 0.20069 |  |  |  |  |  |
| J103 | 0.33142 | 0.25744 | 1.00000 | 0.29043 | 0.22569 | 0.29332 | 0.27870 | 0.26929 | 0.19894 | 0.26395 |
|  | 0.31830 | 0.23922 | 0.21887 | 0.19483 | 0.32117 | 0.21294 | 0.17885 | 0.37334 | 0.21838 | 0.10776 |
|  | 0.22921 | 0.23554 | 0.25229 | 0.25574 | 0.26041 | 0.13096 | 0.27447 | 0.34302 | 0.26709 | 0.12394 |
|  | 0.29851 | 0.13316 | 0.22007 | 0.18540 | 0.30940 | 0.17912 | 0.19937 | 0.20954 | 0.16755 | 0.13751 |
|  | 0.17154 | 0.22286 | 0.15881 | 0.21545 | 0.30422 | 0.09800 | 0.21892 | 0.22128 | 0.16487 | 0.21465 |
|  | 0.16324 | 0.07617 | 0.13251 | 0.28797 | 0.26846 |  |  |  |  |  |
| J104 | 0.27233 | 0.29398 | 0.29043 | 1.00000 | 0.39883 | 0.31907 | 0.36837 | 0.31992 | 0.24911 | 0.30267 |
|  | 0.34721 | 0.20428 | 0.27708 | 0.27711 | 0.28433 | 0.13762 | 0.19176 | 0.29315 | 0.37348 | 0.11671 |
|  | 0.22498 | 0.21369 | 0.26077 | 0.29045 | 0.29474 | 0.21978 | 0.26971 | 0.38054 | 0.34684 | 0.18866 |
|  | 0.35477 | 0.15407 | 0.43199 | 0.12502 | 0.37596 | 0.23601 | 0.30466 | 0.19580 | 0.15284 | 0.33623 |
|  | 0.29254 | 0.25167 | 0.12727 | 0.23514 | 0.41563 | 0.18405 | 0.19656 | 0.30094 | 0.22374 | 0.20047 |
|  | 0.21615 | 0.19910 | 0.12740 | 0.31191 | 0.23505 |  |  |  |  |  |
| J105 | 0.36527 | 0.31323 | 0.22569 | 0.39883 | 1.00000 | 0.30991 | 0.34336 | 0.40032 | 0.26986 | 0.35883 |
|  | 0.45612 | 0.23763 | 0.28128 | 0.26241 | 0.30027 | 0.16277 | 0.27616 | 0.26098 | 0.32569 | 0.14302 |
|  | 0.26217 | 0.21015 | 0.21113 | 0.32009 | 0.21887 | 0.22925 | 0.27605 | 0.33256 | 0.39452 | 0.25486 |
|  | 0.35614 | 0.13377 | 0.41424 | 0.10697 | 0.40355 | 0.20881 | 0.32481 | 0.22164 | 0.28243 | 0.32547 |
|  | 0.24058 | 0.32786 | 0.22472 | 0.29897 | 0.43677 | 0.20639 | 0.24142 | 0.24620 | 0.31215 | 0.21091 |
|  | 0.15990 | 0.24051 | 0.22750 | 0.39625 | 0.36754 |  |  |  |  |  |
| J106 | 0.23930 | 0.27692 | 0.29332 | 0.31907 | 0.30991 | 1.00000 | 0.21231 | 0.26363 | 0.21671 | 0.27603 |
|  | 0.29502 | 0.19027 | 0.24077 | 0.12964 | 0.21712 | 0.16374 | 0.19719 | 0.21194 | 0.32772 | 0.01639 |
|  | 0.19895 | 0.13890 | 0.20067 | 0.14805 | 0.25926 | 0.16085 | 0.17443 | 0.19679 | 0.20856 | 0.22147 |
|  | 0.26351 | 0.15887 | 0.24655 | 0.05390 | 0.30965 | 0.17535 | 0.24218 | 0.17377 | 0.14348 | 0.16832 |
|  | 0.20358 | 0.23799 | 0.11370 | 0.21841 | 0.26008 | 0.07512 | 0.14409 | 0.19499 | 0.19201 | 0.14742 |
|  | 0.11725 | 0.20108 | 0.08912 | 0.21864 | 0.20874 |  |  |  |  |  |

## TABLE 5-6 (Continued)

```
J107   0.25433  0.22315  0.27870  0.36837  0.34336  0.21231  1.00000  0.27784  0.24037  0.28396
       0.30830  0.14291  0.25336  0.18064  0.23108  0.16250  0.16042  0.27873  0.36437  0.07921
       0.17741  0.19873  0.16130  0.36686  0.23335  0.15881  0.31874  0.23400  0.35473  0.13672
       0.28634  0.13519  0.34570  0.06630  0.33735  0.22421  0.24195  0.18167  0.18195  0.24148
       0.16667  0.21866  0.12525  0.14786  0.42737  0.22039  0.22579  0.23125  0.23282  0.13768
       0.14747  0.17926  0.10483  0.27648  0.30746

J108   0.28207  0.34279  0.26929  0.31992  0.40032  0.26363  0.27784  1.00000  0.14605  0.24479
       0.42276  0.23951  0.27054  0.25802  0.36545  0.27495  0.25173  0.14620  0.24056  0.18819
       0.26281  0.29821  0.25560  0.28728  0.25657  0.25432  0.32762  0.34936  0.36361  0.22637
       0.35007  0.20079  0.42225  0.11014  0.41884  0.27501  0.24471  0.12418  0.21784  0.33301
       0.22206  0.32157  0.23348  0.44349  0.39355  0.14182  0.32500  0.27689  0.29693  0.25023
       0.15689  0.17722  0.21716  0.28132  0.23489

J109   0.25357  0.17459  0.19894  0.24911  0.26986  0.21671  0.24037  0.14605  1.00000  0.19502
       0.29407  0.14462  0.09173  0.14285  0.17570  0.07347  0.14721  0.25028  0.31049  0.09826
       0.15980  0.15639  0.17222  0.24806  0.19831  0.09477  0.20105  0.15462  0.17544  0.13319
       0.22427  0.04003  0.19625  0.06872  0.25135  0.08832  0.14591  0.12897  0.13597  0.13506
       0.08800  0.09323  0.08599  0.11783  0.21396  0.09231  0.18190  0.19272  0.19163  0.13087
       0.15005  0.0      0.0      0.12347  0.26572

J110   0.20154  0.21537  0.26395  0.30267  0.35883  0.27603  0.28396  0.24479  0.19502  1.00000
       0.34715  0.10876  0.17541  0.18712  0.24057  0.07868  0.23930  0.15953  0.27441  0.08441
       0.16808  0.23478  0.20961  0.23219  0.19382  0.20060  0.15502  0.22003  0.31175  0.23563
       0.23766  0.04709  0.28349  0.05018  0.39802  0.16685  0.19084  0.28835  0.18384  0.43748
       0.25913  0.24541  0.14203  0.21089  0.42511  0.03832  0.20739  0.27424  0.22393  0.13608
       0.10603  0.32331  0.05963  0.31022  0.21264

J111   0.44109  0.36948  0.31830  0.34721  0.45612  0.29502  0.30830  0.42276  0.29407  0.34715
       1.00000  0.33203  0.25644  0.29944  0.39185  0.15326  0.21980  0.38704  0.35815  0.22610
       0.30293  0.31310  0.26753  0.34079  0.27374  0.28111  0.35573  0.42995  0.37403  0.19589
       0.42603  0.20111  0.47531  0.17264  0.44115  0.24768  0.38724  0.15171  0.25987  0.33938
       0.22705  0.32337  0.25778  0.40524  0.42631  0.16991  0.34050  0.32743  0.28496  0.33624
       0.26151  0.13547  0.11726  0.31467  0.30765

J112   0.30687  0.21190  0.23922  0.20428  0.23763  0.19027  0.14291  0.23951  0.14462  0.10876
       0.33203  1.00000  0.16712  0.18685  0.23806  0.07220  0.12531  0.27621  0.23957  0.07077
       0.16608  0.20443  0.13270  0.18413  0.17685  0.09405  0.19319  0.23735  0.15875  0.11378
       0.33084  0.16503  0.30844  0.13499  0.19655  0.14877  0.20481  0.09837  0.08667  0.12883
       0.13857  0.19689  0.10543  0.27379  0.25177  0.19275  0.20485  0.15949  0.15550  0.17349
       0.24092  0.01806  0.03083  0.18573  0.19613

J113   0.25598  0.22886  0.21887  0.27708  0.28128  0.24077  0.25336  0.27054  0.09173  0.17541
       0.25644  0.16712  1.00000  0.23361  0.25438  0.12733  0.13086  0.29373  0.28005  0.10190
       0.24144  0.21350  0.22188  0.21431  0.19665  0.16169  0.23829  0.27671  0.25009  0.08777
       0.27066  0.12520  0.36584  0.12794  0.27203  0.15859  0.15876  0.17976  0.15122  0.19860
       0.20395  0.19295  0.16608  0.20729  0.27686  0.13608  0.20758  0.17889  0.19742  0.24099
       0.17705  0.14128  0.15630  0.15045  0.23394
```

## TABLE 5-6 (Continued)

```
J114   0.25899  0.16958  0.19483  0.27711  0.26241  0.12964  0.18064  0.25802  0.14285  0.18712
       0.29944  0.18685  0.23361  1.00000  0.22788  0.07992  0.08776  0.17771  0.18293  0.21394
       0.14379  0.19305  0.18617  0.17193  0.17029  0.16577  0.11032  0.23014  0.19787  0.16615
       0.22843  0.14648  0.28086  0.12639  0.25131  0.11672  0.22922  0.17134  0.24155  0.25380
       0.17281  0.22546  0.14987  0.23806  0.27564  0.22046  0.18024  0.21628  0.17460  0.21402
       0.20080  0.23034  0.11722  0.30724  0.20630

J115   0.35874  0.28203  0.32117  0.28433  0.30027  0.21712  0.23108  0.36545  0.17570  0.24057
       0.39185  0.23806  0.25438  0.22788  1.00000  0.16033  0.18686  0.27299  0.32088  0.20010
       0.23261  0.23216  0.20813  0.29486  0.24404  0.20993  0.21009  0.36513  0.32673  0.07875
       0.44083  0.20370  0.35140  0.16821  0.33462  0.29106  0.29441  0.17413  0.18212  0.16105
       0.26324  0.31606  0.18755  0.37591  0.34045  0.20229  0.30099  0.21082  0.27751  0.23827
       0.18383  0.23861  0.11608  0.38895  0.34037

J116   0.13501  0.17924  0.21294  0.13762  0.16277  0.16374  0.16250  0.27495  0.07347  0.07868
       0.15326  0.07220  0.12733  0.07992  0.16033  1.00000  0.09137  0.15176  0.18260  0.0
       0.17948  0.09866  0.09411  0.21735  0.13678  0.07698  0.12106  0.20224  0.23410  0.07683
       0.19817  0.06611  0.16734  0.08052  0.21932  0.06355  0.08741  0.11501  0.09959  0.08683
       0.08260  0.15879  0.09599  0.16033  0.15846  0.05560  0.18165  0.10337  0.15461  0.09722
       0.11712  0.11474  0.10984  0.17262  0.13721

J117   0.16455  0.19360  0.17885  0.19176  0.27616  0.19719  0.16042  0.25173  0.14721  0.23930
       0.21980  0.12531  0.13086  0.08776  0.18686  0.09137  1.00000  0.17751  0.21416  0.09124
       0.13514  0.13813  0.11486  0.10339  0.14152  0.09807  0.15632  0.17866  0.24670  0.23093
       0.13875  0.11395  0.25244  0.03099  0.30148  0.07023  0.18115  0.15940  0.16099  0.32507
       0.19004  0.22771  0.06333  0.16711  0.24075  0.10858  0.14551  0.10594  0.18375  0.11590
       0.14225  0.18862  0.06820  0.19707  0.14728

J118   0.31979  0.31720  0.37334  0.29315  0.26098  0.21194  0.27873  0.14620  0.25028  0.15953
       0.38704  0.27621  0.29373  0.17771  0.27299  0.15176  0.17751  1.00000  0.30917  0.14337
       0.22924  0.26948  0.19321  0.18322  0.24996  0.12067  0.29364  0.31691  0.37578  0.08011
       0.37381  0.17603  0.21984  0.24208  0.31477  0.19965  0.13113  0.16916  0.22172  0.07863
       0.18901  0.17150  0.14844  0.25302  0.30880  0.25069  0.30975  0.19457  0.23405  0.20069
       0.17846  0.0      0.04572  0.22707  0.33100

J119   0.25637  0.22714  0.21838  0.37348  0.32569  0.32772  0.36437  0.24056  0.31049  0.27441
       0.35815  0.23957  0.28005  0.18293  0.32088  0.18260  0.21416  0.30917  1.00000  0.16613
       0.24679  0.20696  0.23759  0.34858  0.26573  0.11877  0.32507  0.22300  0.34414  0.10955
       0.38984  0.17723  0.31096  0.14381  0.33959  0.27045  0.26995  0.15896  0.15868  0.17015
       0.22872  0.21688  0.11599  0.21882  0.38464  0.14742  0.23838  0.28662  0.22880  0.24063
       0.21557  0.14871  0.08792  0.28325  0.29952

J120   0.17382  0.15051  0.10776  0.11671  0.14302  0.01639  0.07921  0.18819  0.09826  0.08441
       0.22610  0.07077  0.10190  0.21394  0.20010  0.0      0.09124  0.14337  0.16613  1.00000
       0.08931  0.16613  0.14348  0.14658  0.04695  0.12609  0.13668  0.16621  0.15922  0.11207
       0.21911  0.12013  0.15776  0.09463  0.19574  0.10586  0.14327  0.09745  0.09856  0.12308
       0.08885  0.18218  0.16400  0.25024  0.11525  0.13601  0.12167  0.06122  0.13790  0.13285
       0.12682  0.08253  0.05798  0.14630  0.14222
```

## TABLE 5-6 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J121 | 0.26701 | 0.22386 | 0.22921 | 0.22498 | 0.26217 | 0.19895 | 0.17741 | 0.26281 | 0.15980 | 0.16808 |
| | 0.30293 | 0.16608 | 0.24144 | 0.14379 | 0.23261 | 0.17948 | 0.13514 | 0.22924 | 0.24679 | 0.08931 |
| | 1.00000 | 0.14822 | 0.18051 | 0.23476 | 0.19684 | 0.15852 | 0.16705 | 0.27026 | 0.26302 | 0.17480 |
| | 0.24744 | 0.13178 | 0.24492 | 0.15584 | 0.30938 | 0.16325 | 0.21457 | 0.20861 | 0.16478 | 0.18777 |
| | 0.18000 | 0.24304 | 0.11680 | 0.20554 | 0.27084 | 0.07858 | 0.23123 | 0.22511 | 0.20477 | 0.17525 |
| | 0.09386 | 0.11705 | 0.03879 | 0.17564 | 0.25124 | | | | | |
| J122 | 0.27938 | 0.17091 | 0.23554 | 0.21369 | 0.21015 | 0.13890 | 0.19873 | 0.29821 | 0.15639 | 0.23478 |
| | 0.31310 | 0.20443 | 0.21350 | 0.19305 | 0.23216 | 0.09866 | 0.13813 | 0.26948 | 0.20696 | 0.16613 |
| | 0.14822 | 1.00000 | 0.23010 | 0.17548 | 0.19285 | 0.09777 | 0.16559 | 0.25323 | 0.22268 | 0.15501 |
| | 0.28317 | 0.16255 | 0.20483 | 0.15391 | 0.22247 | 0.12006 | 0.16127 | 0.08797 | 0.14410 | 0.17181 |
| | 0.19407 | 0.17922 | 0.11943 | 0.19665 | 0.22290 | 0.17198 | 0.15208 | 0.21624 | 0.18696 | 0.19307 |
| | 0.11912 | 0.18774 | 0.08175 | 0.20634 | 0.22787 | | | | | |
| J123 | 0.30775 | 0.18226 | 0.25229 | 0.26077 | 0.21113 | 0.20067 | 0.16130 | 0.25560 | 0.17222 | 0.20961 |
| | 0.26753 | 0.13270 | 0.22188 | 0.18617 | 0.20813 | 0.09411 | 0.11486 | 0.19321 | 0.23759 | 0.14348 |
| | 0.18051 | 0.23010 | 1.00000 | 0.18694 | 0.17000 | 0.13629 | 0.19957 | 0.25189 | 0.22196 | 0.10383 |
| | 0.32267 | 0.08987 | 0.24730 | 0.10662 | 0.27183 | 0.18694 | 0.22461 | 0.11801 | 0.18303 | 0.19223 |
| | 0.13617 | 0.18347 | 0.15809 | 0.23374 | 0.26506 | 0.07150 | 0.21101 | 0.19376 | 0.20994 | 0.22978 |
| | 0.12436 | 0.12239 | 0.08128 | 0.25847 | 0.21100 | | | | | |
| J124 | 0.22350 | 0.26193 | 0.25574 | 0.29045 | 0.32009 | 0.14805 | 0.36686 | 0.28728 | 0.24806 | 0.23219 |
| | 0.34079 | 0.18413 | 0.21431 | 0.17193 | 0.29486 | 0.21735 | 0.10339 | 0.18322 | 0.34858 | 0.14658 |
| | 0.23476 | 0.17548 | 0.18694 | 1.00000 | 0.21060 | 0.09607 | 0.30612 | 0.27290 | 0.32963 | 0.10086 |
| | 0.25929 | 0.09877 | 0.24908 | 0.14339 | 0.33303 | 0.13512 | 0.25599 | 0.18122 | 0.16942 | 0.19556 |
| | 0.06978 | 0.23359 | 0.14090 | 0.21475 | 0.35273 | 0.17852 | 0.21528 | 0.22483 | 0.22865 | 0.16921 |
| | 0.14340 | 0.17997 | 0.09809 | 0.31173 | 0.29452 | | | | | |
| J125 | 0.21587 | 0.18780 | 0.26041 | 0.29474 | 0.21887 | 0.25926 | 0.23335 | 0.25657 | 0.19831 | 0.19382 |
| | 0.27374 | 0.17685 | 0.19665 | 0.17029 | 0.24404 | 0.13678 | 0.14152 | 0.24996 | 0.26573 | 0.04695 |
| | 0.19684 | 0.19285 | 0.17000 | 0.21060 | 1.00000 | 0.14414 | 0.18841 | 0.23249 | 0.21926 | 0.11469 |
| | 0.28249 | 0.08750 | 0.28976 | 0.10011 | 0.33479 | 0.08492 | 0.18027 | 0.10161 | 0.11273 | 0.19822 |
| | 0.09911 | 0.20644 | 0.15297 | 0.21972 | 0.30816 | 0.06034 | 0.20784 | 0.19402 | 0.11619 | 0.08219 |
| | 0.09979 | 0.07949 | 0.03311 | 0.23501 | 0.16628 | | | | | |
| J126 | 0.19550 | 0.14647 | 0.13096 | 0.21978 | 0.22925 | 0.16085 | 0.15881 | 0.25432 | 0.09477 | 0.20060 |
| | 0.28111 | 0.09405 | 0.16169 | 0.16577 | 0.20993 | 0.07698 | 0.09807 | 0.12067 | 0.11877 | 0.12609 |
| | 0.15852 | 0.09777 | 0.13629 | 0.09607 | 0.14414 | 1.00000 | 0.11030 | 0.23396 | 0.17336 | 0.07940 |
| | 0.18567 | 0.15703 | 0.23999 | 0.12204 | 0.22956 | 0.08941 | 0.18499 | 0.05259 | 0.14649 | 0.25681 |
| | 0.16946 | 0.20932 | 0.10244 | 0.17712 | 0.25528 | 0.08984 | 0.17516 | 0.14479 | 0.18517 | 0.15224 |
| | 0.10736 | 0.16118 | 0.0 | 0.23388 | 0.12261 | | | | | |
| J127 | 0.27860 | 0.17569 | 0.27447 | 0.26971 | 0.27605 | 0.17443 | 0.31874 | 0.32762 | 0.20105 | 0.15502 |
| | 0.35573 | 0.19319 | 0.23829 | 0.11032 | 0.21009 | 0.12106 | 0.15632 | 0.29364 | 0.32507 | 0.13668 |
| | 0.16705 | 0.16559 | 0.19957 | 0.30612 | 0.18841 | 0.11030 | 1.00000 | 0.29571 | 0.24269 | 0.16406 |
| | 0.39992 | 0.12196 | 0.30306 | 0.06765 | 0.31400 | 0.18481 | 0.26615 | 0.09441 | 0.16295 | 0.13480 |
| | 0.12685 | 0.19284 | 0.15311 | 0.22816 | 0.28276 | 0.13533 | 0.23871 | 0.24867 | 0.20771 | 0.18030 |
| | 0.16340 | 0.0 | 0.07434 | 0.25315 | 0.29270 | | | | | |

## TABLE 5-6 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J128 | 0.33976 | 0.30612 | 0.34302 | 0.38054 | 0.33256 | 0.19679 | 0.23400 | 0.34936 | 0.15462 | 0.22003 |
| | 0.42995 | 0.23735 | 0.27671 | 0.23014 | 0.36513 | 0.20224 | 0.17866 | 0.31691 | 0.22300 | 0.16621 |
| | 0.27026 | 0.25323 | 0.25189 | 0.27290 | 0.23249 | 0.23396 | 0.29571 | 1.00000 | 0.26566 | 0.20944 |
| | 0.34207 | 0.18934 | 0.39398 | 0.22018 | 0.29566 | 0.19762 | 0.24486 | 0.15540 | 0.19334 | 0.27771 |
| | 0.20064 | 0.29057 | 0.22738 | 0.33406 | 0.33929 | 0.16378 | 0.23198 | 0.26730 | 0.30003 | 0.20921 |
| | 0.19437 | 0.10892 | 0.17452 | 0.31683 | 0.25591 | | | | | |
| J129 | 0.34834 | 0.22842 | 0.26709 | 0.34684 | 0.39452 | 0.20856 | 0.35473 | 0.36361 | 0.17544 | 0.31175 |
| | 0.37403 | 0.15875 | 0.25009 | 0.19787 | 0.32673 | 0.23410 | 0.24670 | 0.37578 | 0.34414 | 0.15922 |
| | 0.26302 | 0.22268 | 0.22196 | 0.32963 | 0.21926 | 0.17336 | 0.24269 | 0.26566 | 1.00000 | 0.09298 |
| | 0.38685 | 0.25385 | 0.37280 | 0.18039 | 0.47290 | 0.16772 | 0.37928 | 0.24701 | 0.25089 | 0.28912 |
| | 0.26979 | 0.30165 | 0.14219 | 0.27176 | 0.47198 | 0.20604 | 0.27218 | 0.21873 | 0.23784 | 0.25906 |
| | 0.21095 | 0.27064 | 0.12969 | 0.35584 | 0.40009 | | | | | |
| J130 | 0.16264 | 0.15818 | 0.12394 | 0.18866 | 0.25486 | 0.22147 | 0.13672 | 0.22637 | 0.13319 | 0.23563 |
| | 0.19589 | 0.11378 | 0.08777 | 0.16615 | 0.07875 | 0.07683 | 0.23093 | 0.08011 | 0.10955 | 0.11207 |
| | 0.17480 | 0.15501 | 0.10383 | 0.10086 | 0.11469 | 0.07940 | 0.16406 | 0.20944 | 0.09298 | 1.00000 |
| | 0.20916 | 0.05631 | 0.29100 | 0.10049 | 0.23186 | 0.09031 | 0.11970 | 0.13281 | 0.07600 | 0.33837 |
| | 0.24257 | 0.21790 | 0.14122 | 0.17200 | 0.22006 | 0.03235 | 0.06391 | 0.16538 | 0.15585 | 0.09405 |
| | 0.12188 | 0.19414 | 0.06860 | 0.16921 | 0.18932 | | | | | |
| J131 | 0.39523 | 0.28004 | 0.29851 | 0.35477 | 0.35614 | 0.26351 | 0.28634 | 0.35007 | 0.22427 | 0.23766 |
| | 0.42603 | 0.33084 | 0.27066 | 0.22843 | 0.44083 | 0.19817 | 0.13875 | 0.37381 | 0.38984 | 0.21911 |
| | 0.24744 | 0.28317 | 0.32267 | 0.25929 | 0.28249 | 0.18567 | 0.39992 | 0.34207 | 0.38685 | 0.20916 |
| | 1.00000 | 0.22419 | 0.30519 | 0.17637 | 0.32348 | 0.24167 | 0.40561 | 0.16901 | 0.24339 | 0.15636 |
| | 0.27082 | 0.27667 | 0.22135 | 0.37320 | 0.34477 | 0.19225 | 0.32473 | 0.29826 | 0.29311 | 0.22007 |
| | 0.24071 | 0.12817 | 0.06342 | 0.38645 | 0.33690 | | | | | |
| J132 | 0.15432 | 0.15986 | 0.13316 | 0.15407 | 0.13377 | 0.15887 | 0.13519 | 0.20079 | 0.04003 | 0.04709 |
| | 0.20111 | 0.16503 | 0.12520 | 0.14648 | 0.20370 | 0.06611 | 0.11395 | 0.17603 | 0.17723 | 0.12013 |
| | 0.13178 | 0.16255 | 0.08987 | 0.09877 | 0.08750 | 0.15703 | 0.12196 | 0.18934 | 0.25385 | 0.05631 |
| | 0.22419 | 1.00000 | 0.19126 | 0.02586 | 0.13962 | 0.10351 | 0.21718 | 0.12262 | 0.14845 | 0.15659 |
| | 0.11299 | 0.16586 | 0.09358 | 0.15594 | 0.20566 | 0.15917 | 0.17611 | 0.06750 | 0.13792 | 0.13352 |
| | 0.16686 | 0.11354 | 0.04264 | 0.21810 | 0.15306 | | | | | |
| J133 | 0.29977 | 0.32263 | 0.22007 | 0.43199 | 0.41424 | 0.24655 | 0.34570 | 0.42225 | 0.19625 | 0.28349 |
| | 0.47531 | 0.30844 | 0.36584 | 0.28086 | 0.35140 | 0.16734 | 0.25244 | 0.21984 | 0.31096 | 0.15776 |
| | 0.24492 | 0.20483 | 0.24730 | 0.24908 | 0.28976 | 0.23999 | 0.30306 | 0.39398 | 0.37280 | 0.29100 |
| | 0.30519 | 0.19126 | 1.00000 | 0.16653 | 0.50279 | 0.25152 | 0.33835 | 0.18754 | 0.20965 | 0.45558 |
| | 0.23681 | 0.31902 | 0.17279 | 0.27826 | 0.45700 | 0.10823 | 0.21136 | 0.29921 | 0.26615 | 0.19620 |
| | 0.22365 | 0.18748 | 0.07861 | 0.36121 | 0.20363 | | | | | |
| J134 | 0.23934 | 0.15234 | 0.18540 | 0.12502 | 0.10697 | 0.05390 | 0.06630 | 0.11014 | 0.06872 | 0.05018 |
| | 0.17264 | 0.13499 | 0.12794 | 0.12639 | 0.16821 | 0.08052 | 0.03099 | 0.24208 | 0.14381 | 0.09463 |
| | 0.15584 | 0.15391 | 0.10662 | 0.14339 | 0.10011 | 0.12204 | 0.06765 | 0.22018 | 0.18039 | 0.10049 |
| | 0.17637 | 0.02586 | 0.16653 | 1.00000 | 0.20581 | 0.11377 | 0.09519 | 0.15572 | 0.09725 | 0.05475 |
| | 0.12820 | 0.10349 | 0.12740 | 0.18434 | 0.16620 | 0.14809 | 0.17437 | 0.20721 | 0.13311 | 0.15843 |
| | 0.19422 | 0.12645 | 0.05182 | 0.14986 | 0.22182 | | | | | |

## TABLE 5-6 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J135 | 0.32843 | 0.29703 | 0.30940 | 0.37596 | 0.40355 | 0.30965 | 0.33735 | 0.41884 | 0.25135 | 0.39802 |
| | 0.44115 | 0.19655 | 0.27203 | 0.25131 | 0.33462 | 0.21932 | 0.30148 | 0.31477 | 0.33959 | 0.19574 |
| | 0.30938 | 0.22247 | 0.27183 | 0.33303 | 0.33479 | 0.22956 | 0.31400 | 0.29566 | 0.47290 | 0.23186 |
| | 0.32348 | 0.13962 | 0.50279 | 0.20581 | 1.00000 | 0.17838 | 0.29010 | 0.25644 | 0.22116 | 0.37688 |
| | 0.23804 | 0.33200 | 0.20709 | 0.27905 | 0.48112 | 0.12541 | 0.27848 | 0.27024 | 0.27508 | 0.25137 |
| | 0.21813 | 0.24021 | 0.15914 | 0.38449 | 0.36803 | | | | | |
| J136 | 0.18602 | 0.13125 | 0.17912 | 0.23601 | 0.20881 | 0.17535 | 0.22421 | 0.27501 | 0.08832 | 0.16685 |
| | 0.24768 | 0.14877 | 0.15859 | 0.11672 | 0.29106 | 0.06355 | 0.07023 | 0.19965 | 0.27045 | 0.10586 |
| | 0.16325 | 0.12006 | 0.18694 | 0.13512 | 0.08492 | 0.08941 | 0.18481 | 0.19762 | 0.16772 | 0.09031 |
| | 0.24167 | 0.10351 | 0.25152 | 0.11377 | 0.17838 | 1.00000 | 0.09972 | 0.07236 | 0.02829 | 0.10692 |
| | 0.17301 | 0.10385 | 0.03479 | 0.17977 | 0.22558 | 0.11429 | 0.12541 | 0.12272 | 0.16104 | 0.13560 |
| | 0.17446 | 0.15578 | 0.0 | 0.26516 | 0.19782 | | | | | |
| J137 | 0.30441 | 0.22780 | 0.19937 | 0.30466 | 0.32481 | 0.24218 | 0.24195 | 0.24471 | 0.14591 | 0.19084 |
| | 0.38724 | 0.20481 | 0.15876 | 0.22922 | 0.29441 | 0.08741 | 0.18115 | 0.13113 | 0.26995 | 0.14327 |
| | 0.21457 | 0.16127 | 0.22461 | 0.25599 | 0.18027 | 0.18499 | 0.26615 | 0.24486 | 0.37928 | 0.11970 |
| | 0.40561 | 0.21718 | 0.33835 | 0.09519 | 0.29010 | 0.09972 | 1.00000 | 0.22846 | 0.22926 | 0.25172 |
| | 0.20554 | 0.33172 | 0.16924 | 0.28529 | 0.39447 | 0.17574 | 0.22648 | 0.22475 | 0.20772 | 0.16864 |
| | 0.17530 | 0.15884 | 0.16520 | 0.29146 | 0.32471 | | | | | |
| J139 | 0.16192 | 0.19857 | 0.20954 | 0.19580 | 0.22164 | 0.17377 | 0.18167 | 0.12418 | 0.12897 | 0.28835 |
| | 0.15171 | 0.09837 | 0.17976 | 0.17134 | 0.17413 | 0.11501 | 0.15940 | 0.16916 | 0.15896 | 0.09745 |
| | 0.20861 | 0.08797 | 0.11801 | 0.18122 | 0.10161 | 0.05259 | 0.09441 | 0.15540 | 0.24701 | 0.13281 |
| | 0.16901 | 0.12262 | 0.18754 | 0.15572 | 0.25644 | 0.07236 | 0.22846 | 1.00000 | 0.12863 | 0.22196 |
| | 0.11505 | 0.17487 | 0.14794 | 0.16122 | 0.19638 | 0.12254 | 0.12839 | 0.19612 | 0.16847 | 0.20690 |
| | 0.14566 | 0.22065 | 0.14440 | 0.19647 | 0.27873 | | | | | |
| J140 | 0.22883 | 0.13798 | 0.16755 | 0.15284 | 0.28243 | 0.14348 | 0.18195 | 0.21784 | 0.13597 | 0.18384 |
| | 0.25987 | 0.08667 | 0.15122 | 0.24155 | 0.18212 | 0.09959 | 0.16099 | 0.22172 | 0.15868 | 0.09856 |
| | 0.16478 | 0.14410 | 0.18303 | 0.16942 | 0.11273 | 0.14649 | 0.16295 | 0.19334 | 0.25089 | 0.07600 |
| | 0.24339 | 0.14845 | 0.20965 | 0.09725 | 0.22116 | 0.02829 | 0.22926 | 0.12863 | 1.00000 | 0.17290 |
| | 0.13226 | 0.20887 | 0.63435 | 0.24907 | 0.20858 | 0.12060 | 0.19040 | 0.12477 | 0.21136 | 0.12041 |
| | 0.07825 | 0.11136 | 0.07829 | 0.21644 | 0.18541 | | | | | |
| J141 | 0.24048 | 0.15917 | 0.13751 | 0.33623 | 0.32547 | 0.16832 | 0.24148 | 0.33301 | 0.13506 | 0.43748 |
| | 0.33938 | 0.12883 | 0.19860 | 0.25380 | 0.16105 | 0.08683 | 0.32507 | 0.07863 | 0.17015 | 0.12308 |
| | 0.18777 | 0.17181 | 0.19223 | 0.19556 | 0.19822 | 0.25681 | 0.13480 | 0.27771 | 0.28912 | 0.33837 |
| | 0.15636 | 0.15659 | 0.45558 | 0.05475 | 0.37688 | 0.10692 | 0.25172 | 0.22196 | 0.17290 | 1.00000 |
| | 0.34401 | 0.31472 | 0.18929 | 0.22335 | 0.34323 | 0.11664 | 0.13520 | 0.16756 | 0.23385 | 0.14267 |
| | 0.10738 | 0.33450 | 0.23139 | 0.27829 | 0.16112 | | | | | |
| J142 | 0.20900 | 0.13424 | 0.17154 | 0.29254 | 0.24058 | 0.20358 | 0.16667 | 0.22206 | 0.08800 | 0.25913 |
| | 0.22705 | 0.13857 | 0.20395 | 0.17281 | 0.26324 | 0.08260 | 0.19004 | 0.18901 | 0.22872 | 0.08885 |
| | 0.18000 | 0.19407 | 0.13617 | 0.06978 | 0.09911 | 0.16946 | 0.12685 | 0.20064 | 0.26979 | 0.24257 |
| | 0.27082 | 0.11299 | 0.23681 | 0.12820 | 0.23804 | 0.17301 | 0.20554 | 0.11505 | 0.13226 | 0.34401 |
| | 1.00000 | 0.26053 | 0.10648 | 0.22793 | 0.27777 | 0.20325 | 0.19319 | 0.21504 | 0.17817 | 0.15088 |
| | 0.15617 | 0.21365 | 0.06436 | 0.24658 | 0.21961 | | | | | |

TABLE 5-6 (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| J143 | 0.26363 | 0.25861 | 0.22286 | 0.25167 | 0.32786 | 0.23799 | 0.21866 | 0.32157 | 0.09323 | 0.24541 |
| | 0.32337 | 0.19689 | 0.19295 | 0.22546 | 0.31606 | 0.15879 | 0.22771 | 0.17150 | 0.21688 | 0.18218 |
| | 0.24304 | 0.17922 | 0.18347 | 0.23359 | 0.20644 | 0.20932 | 0.19284 | 0.29057 | 0.30165 | 0.21790 |
| | 0.27667 | 0.16586 | 0.31902 | 0.10349 | 0.33200 | 0.10385 | 0.33172 | 0.17487 | 0.20887 | 0.31472 |
| | 0.26053 | 1.00000 | 0.25049 | 0.32613 | 0.34481 | 0.17781 | 0.24625 | 0.19530 | 0.25801 | 0.20318 |
| | 0.19823 | 0.18479 | 0.15601 | 0.31193 | 0.30804 | | | | | |
| J144 | 0.24065 | 0.14061 | 0.15881 | 0.12727 | 0.22472 | 0.11370 | 0.12525 | 0.23348 | 0.08599 | 0.14203 |
| | 0.25778 | 0.10543 | 0.16608 | 0.14987 | 0.18755 | 0.09599 | 0.06333 | 0.14844 | 0.11599 | 0.16400 |
| | 0.11680 | 0.11943 | 0.15809 | 0.14090 | 0.15297 | 0.10244 | 0.15311 | 0.22738 | 0.14219 | 0.14122 |
| | 0.22135 | 0.09358 | 0.17279 | 0.12740 | 0.20709 | 0.03479 | 0.16924 | 0.14794 | 0.63435 | 0.18929 |
| | 0.10648 | 0.25049 | 1.00000 | 0.24204 | 0.18547 | 0.11842 | 0.17357 | 0.17821 | 0.19224 | 0.14804 |
| | 0.09083 | 0.14937 | 0.08145 | 0.17369 | 0.13285 | | | | | |
| J145 | 0.33405 | 0.23948 | 0.21545 | 0.23514 | 0.29897 | 0.21841 | 0.14786 | 0.44349 | 0.11783 | 0.21089 |
| | 0.40524 | 0.27379 | 0.20729 | 0.23806 | 0.37591 | 0.16033 | 0.16711 | 0.25302 | 0.21882 | 0.25024 |
| | 0.20554 | 0.19665 | 0.23374 | 0.21475 | 0.21972 | 0.17712 | 0.22816 | 0.33406 | 0.27176 | 0.17200 |
| | 0.37320 | 0.15594 | 0.27826 | 0.18434 | 0.27905 | 0.17977 | 0.28529 | 0.16122 | 0.24907 | 0.22335 |
| | 0.22793 | 0.32613 | 0.24204 | 1.00000 | 0.28123 | 0.10293 | 0.28257 | 0.30198 | 0.28297 | 0.28311 |
| | 0.25394 | 0.20950 | 0.0 | 0.26637 | 0.26383 | | | | | |
| J146 | 0.36443 | 0.26860 | 0.30422 | 0.41563 | 0.43677 | 0.26008 | 0.42737 | 0.39355 | 0.21396 | 0.42511 |
| | 0.42631 | 0.25177 | 0.27686 | 0.27564 | 0.34045 | 0.15846 | 0.24075 | 0.30880 | 0.38464 | 0.11525 |
| | 0.27084 | 0.22290 | 0.26506 | 0.35273 | 0.30816 | 0.25528 | 0.28276 | 0.33929 | 0.47198 | 0.22006 |
| | 0.34477 | 0.20566 | 0.45700 | 0.16620 | 0.48112 | 0.22558 | 0.39447 | 0.19638 | 0.20858 | 0.34323 |
| | 0.27777 | 0.34481 | 0.18547 | 0.28123 | 1.00000 | 0.20066 | 0.26529 | 0.29355 | 0.30091 | 0.27123 |
| | 0.18813 | 0.27056 | 0.16733 | 0.37390 | 0.30743 | | | | | |
| J147 | 0.19770 | 0.11470 | 0.09800 | 0.18405 | 0.20639 | 0.07512 | 0.22039 | 0.14182 | 0.09231 | 0.03832 |
| | 0.16991 | 0.19275 | 0.13608 | 0.22046 | 0.20229 | 0.05560 | 0.10858 | 0.25069 | 0.14742 | 0.13601 |
| | 0.07858 | 0.17198 | 0.07150 | 0.17852 | 0.06034 | 0.08984 | 0.13533 | 0.16378 | 0.20604 | 0.03235 |
| | 0.19225 | 0.15917 | 0.10823 | 0.14809 | 0.12541 | 0.11429 | 0.17574 | 0.12254 | 0.12060 | 0.11664 |
| | 0.20325 | 0.17781 | 0.11842 | 0.10293 | 0.20066 | 1.00000 | 0.12864 | 0.07918 | 0.10626 | 0.13486 |
| | 0.19435 | 0.15060 | 0.14899 | 0.32530 | 0.28648 | | | | | |
| J148 | 0.30278 | 0.19364 | 0.21892 | 0.19656 | 0.24142 | 0.14409 | 0.22579 | 0.32500 | 0.18190 | 0.20739 |
| | 0.34050 | 0.20485 | 0.20758 | 0.18024 | 0.30099 | 0.18165 | 0.14551 | 0.30975 | 0.23838 | 0.12167 |
| | 0.23123 | 0.15208 | 0.21101 | 0.21528 | 0.20784 | 0.17516 | 0.23871 | 0.23198 | 0.27218 | 0.06391 |
| | 0.32473 | 0.17611 | 0.21136 | 0.17437 | 0.27848 | 0.12541 | 0.22648 | 0.12839 | 0.19040 | 0.13520 |
| | 0.19319 | 0.24625 | 0.17357 | 0.28257 | 0.26529 | 0.12864 | 1.00000 | 0.21042 | 0.20456 | 0.24055 |
| | 0.18185 | 0.14180 | 0.13102 | 0.26804 | 0.26642 | | | | | |
| J149 | 0.21787 | 0.20211 | 0.22128 | 0.30094 | 0.24620 | 0.19499 | 0.23125 | 0.27689 | 0.19272 | 0.27424 |
| | 0.32743 | 0.15949 | 0.17889 | 0.21628 | 0.21082 | 0.10337 | 0.10594 | 0.19457 | 0.28662 | 0.06122 |
| | 0.22511 | 0.21624 | 0.19376 | 0.22483 | 0.19402 | 0.14479 | 0.24867 | 0.26730 | 0.21873 | 0.16538 |
| | 0.29826 | 0.06750 | 0.29921 | 0.20721 | 0.27024 | 0.12272 | 0.22475 | 0.19612 | 0.12477 | 0.16756 |
| | 0.21504 | 0.19530 | 0.17821 | 0.30198 | 0.29355 | 0.07918 | 0.21042 | 1.00000 | 0.21089 | 0.09136 |
| | 0.15225 | 0.21224 | 0.15445 | 0.22000 | 0.25645 | | | | | |

## TABLE 5-6 (Continued)

```
J150    0.27089  0.27458  0.16487  0.22374  0.31215  0.19201  0.23282  0.29693  0.19163  0.22393
        0.28496  0.15550  0.19742  0.17460  0.27751  0.15461  0.18375  0.23405  0.22880  0.13790
        0.20477  0.18696  0.20994  0.22865  0.11619  0.18517  0.20771  0.30003  0.23784  0.15585
        0.29311  0.13792  0.26615  0.13311  0.27508  0.16104  0.20772  0.16847  0.21136  0.23385
        0.17817  0.25801  0.19224  0.28297  0.30091  0.10626  0.20456  0.21089  1.00000  0.21504
        0.16789  0.16944  0.15504  0.27101  0.26161

J151    0.27333  0.20833  0.21465  0.20047  0.21091  0.14742  0.13768  0.25023  0.13087  0.13608
        0.33624  0.17349  0.24099  0.21402  0.23827  0.09722  0.11590  0.20069  0.24063  0.13285
        0.17525  0.19307  0.22978  0.16921  0.08219  0.15224  0.18030  0.20921  0.25906  0.09405
        0.22007  0.13352  0.19620  0.15843  0.25137  0.13560  0.16864  0.20690  0.12041  0.14267
        0.15088  0.20318  0.14804  0.28311  0.27123  0.13486  0.24055  0.09136  0.21504  1.00000
        0.20766  0.17497  0.13576  0.31482  0.33449

J152    0.22068  0.17808  0.16324  0.21615  0.15990  0.11725  0.14747  0.15689  0.15005  0.10603
        0.26151  0.24092  0.17705  0.20080  0.18383  0.11712  0.14225  0.17846  0.21557  0.12682
        0.09386  0.11912  0.12436  0.14340  0.09979  0.10736  0.16340  0.19437  0.21095  0.12188
        0.24071  0.16686  0.22365  0.19422  0.21813  0.17446  0.17530  0.14566  0.07825  0.10738
        0.15617  0.19823  0.09083  0.25394  0.18813  0.19435  0.18185  0.15225  0.16789  0.20766
        1.00000  0.23207  0.12654  0.22525  0.24550

J153    0.15374  0.05059  0.07617  0.19910  0.24051  0.20108  0.17926  0.17722  0.0      0.32331
        0.13547  0.01806  0.14128  0.23034  0.23861  0.11474  0.18862  0.0      0.14871  0.08253
        0.11705  0.18774  0.12239  0.17997  0.07949  0.16118  0.0      0.10892  0.27064  0.19414
        0.12817  0.11354  0.18748  0.12645  0.24021  0.15578  0.15884  0.22065  0.11136  0.33450
        0.21365  0.18479  0.14937  0.20950  0.27056  0.15060  0.14180  0.21224  0.16944  0.17497
        0.23207  1.00000  0.17011  0.31216  0.23174

J154    0.08216  0.09907  0.13251  0.12740  0.22750  0.08912  0.10483  0.21716  0.0      0.05963
        0.11726  0.03083  0.15630  0.11722  0.11608  0.10984  0.06820  0.04572  0.08792  0.05798
        0.03879  0.08175  0.08128  0.09809  0.03311  0.0      0.07434  0.17452  0.12969  0.06860
        0.06342  0.04264  0.07861  0.05182  0.15914  0.0      0.16520  0.14440  0.07829  0.23139
        0.06436  0.15601  0.08145  0.0      0.16733  0.14899  0.13102  0.15445  0.15504  0.13576
        0.12654  0.17011  1.00000  0.20438  0.16377

J155    0.44011  0.17276  0.28797  0.31191  0.39625  0.21864  0.27648  0.28132  0.12347  0.31022
        0.31467  0.18573  0.15045  0.30724  0.38895  0.17262  0.19707  0.22707  0.28325  0.14630
        0.17564  0.20634  0.25847  0.31173  0.23501  0.23388  0.25315  0.31683  0.35584  0.16921
        0.38645  0.21810  0.36121  0.14986  0.38449  0.26516  0.29146  0.19647  0.21644  0.27829
        0.24658  0.31193  0.17369  0.26637  0.37390  0.32530  0.26804  0.22000  0.27101  0.31482
        0.22525  0.31216  0.20438  1.00000  0.43811

J156    0.35716  0.20069  0.26846  0.23505  0.36754  0.20874  0.30746  0.23489  0.26572  0.21264
        0.30765  0.19613  0.23394  0.20630  0.34037  0.13721  0.14728  0.33100  0.29952  0.14222
        0.25124  0.22787  0.21100  0.29452  0.16628  0.12261  0.29270  0.25591  0.40009  0.18932
        0.33690  0.15306  0.20363  0.22182  0.36803  0.19782  0.32471  0.27873  0.18541  0.16112
        0.21961  0.30804  0.13285  0.26383  0.30743  0.28648  0.26642  0.25645  0.26161  0.33449
        0.24550  0.23174  0.16377  0.43811  1.00000
```

tetrachoric correlation matrices of the fifty-five items of Test J1 in these two cases, respectively. It should be noted that in both tables there are many small positive correlation coefficients observed for item J154. In applying factor analysis for these tetrachoric correlation matrices, the principal factor solution was adopted, with 55 and 42 common factors in communality estimation, respectively, in these two separate cases. These are the maximum numbers of common factors useable without making any estimated communalities exceed unity. Tables 5-7 and 5-8 present the resulting eigenvalues in the J1/1075 and J1/2259 Cases, respectively. We can see from each result that there is only one dominating common factor, since all the other eigenvalues are negligibly small, i.e., the unidimensionality of the latent space is confirmed in each case. The factor loadings of these common factors are given in Tables 5-9 and 5-10. In these tables, all those values which exceed 0.300 are marked by ▼ , while those which are negative and whose absolute values exceed the same number are marked by ▽ , except in the first column where all the values except for those of items J120, J134 and J154 in the J1/1075 Case and of items J116, J120, J134 and J154 in the J1/2259 Case do exceed 0.3000 . Observation of these two tables reveals that there exist a few minor clusters such as those of items J141 and J153, and of items J140 and J144 in both cases, but overall the results support the unidimensionality of the latent space.

The estimates of the item discrimination and item difficulty parameters were obtained by (4.1) and (4.2), and the results are

## TABLE 5-7

**Eigenvalues of the Tetrachoric Correlation Matrix in the J1/1075 Case Whose Diagonal Elements Were Replaced by the Estimated Communalities Based upon the Fifty-Five Common Factors, Obtained by the Principal Factor Solution in SPSS Version H, release 9.1.**

| FACTOR | EIGENVALUE | PCT OF VAR | CUM PCT |
|---|---|---|---|
| 1 | 14.07600 | 25.6 | 25.6 |
| 2 | 2.00527 | 3.6 | 29.2 |
| 3 | 1.85225 | 3.4 | 32.6 |
| 4 | 1.68286 | 3.1 | 35.7 |
| 5 | 1.46180 | 2.7 | 38.3 |
| 6 | 1.41706 | 2.6 | 40.9 |
| 7 | 1.34809 | 2.5 | 43.4 |
| 8 | 1.29391 | 2.4 | 45.7 |
| 9 | 1.26612 | 2.3 | 48.0 |
| 10 | 1.21675 | 2.2 | 50.2 |
| 11 | 1.19252 | 2.2 | 52.4 |
| 12 | 1.13169 | 2.1 | 54.4 |
| 13 | 1.08745 | 2.0 | 56.4 |
| 14 | 1.06089 | 1.9 | 58.4 |
| 15 | 1.00829 | 1.8 | 60.2 |
| 16 | 0.98982 | 1.8 | 62.0 |
| 17 | 0.96252 | 1.8 | 63.7 |
| 18 | 0.95201 | 1.7 | 65.5 |
| 19 | 0.89599 | 1.6 | 67.1 |
| 20 | 0.89268 | 1.6 | 68.7 |
| 21 | 0.87130 | 1.6 | 70.3 |
| 22 | 0.83960 | 1.5 | 71.8 |
| 23 | 0.82416 | 1.5 | 73.3 |
| 24 | 0.79013 | 1.4 | 74.8 |
| 25 | 0.76911 | 1.4 | 76.2 |
| 26 | 0.74202 | 1.3 | 77.5 |
| 27 | 0.72782 | 1.3 | 78.8 |
| 28 | 0.70499 | 1.3 | 80.1 |
| 29 | 0.68304 | 1.2 | 81.4 |
| 30 | 0.66735 | 1.2 | 82.6 |
| 31 | 0.66201 | 1.2 | 83.8 |
| 32 | 0.62523 | 1.1 | 84.9 |
| 33 | 0.61147 | 1.1 | 86.0 |
| 34 | 0.60033 | 1.1 | 87.1 |
| 35 | 0.56625 | 1.0 | 88.1 |
| 36 | 0.54957 | 1.0 | 89.1 |
| 37 | 0.52276 | 1.0 | 90.1 |
| 38 | 0.50601 | 0.9 | 91.0 |
| 39 | 0.48853 | 0.9 | 91.9 |
| 40 | 0.45904 | 0.8 | 92.7 |
| 41 | 0.43907 | 0.8 | 93.5 |
| 42 | 0.42453 | 0.8 | 94.3 |
| 43 | 0.39065 | 0.7 | 95.0 |
| 44 | 0.35969 | 0.7 | 95.7 |
| 45 | 0.33716 | 0.6 | 96.3 |
| 46 | 0.32326 | 0.6 | 96.9 |
| 47 | 0.30133 | 0.5 | 97.4 |
| 48 | 0.27201 | 0.5 | 97.9 |
| 49 | 0.25921 | 0.5 | 98.4 |
| 50 | 0.23477 | 0.4 | 98.8 |
| 51 | 0.19081 | 0.3 | 99.2 |
| 52 | 0.15292 | 0.3 | 99.4 |
| 53 | 0.14473 | 0.3 | 99.7 |
| 54 | 0.09919 | 0.2 | 99.9 |
| 55 | 0.06580 | 0.1 | 100.0 |

## TABLE 5-8

**Eigenvalues of the Tetrachoric Correlation Matrix in the J1/2259 Case Whose Diagonal Elements Were Replaced by the Estimated Communalities Based upon the Forty-Two Common Factors, Obtained by the Principal Factor Solution in BMDP4M Revised in 1982.**

| FACTOR | VARIANCE EXPLAINED | CUMULATIVE PROPORTION OF VARIANCE | |
|---|---|---|---|
| | | IN DATA SPACE | IN FACTOR SPACE |
| 1 | 12.5805 | 0.3722 | 0.3748 |
| 2 | 1.6690 | 0.4216 | 0.4245 |
| 3 | 1.3843 | 0.4625 | 0.4658 |
| 4 | 1.2342 | 0.4990 | 0.5025 |
| 5 | 1.0798 | 0.5310 | 0.5347 |
| 6 | 0.8874 | 0.5572 | 0.5612 |
| 7 | 0.8429 | 0.5822 | 0.5863 |
| 8 | 0.8042 | 0.6059 | 0.6102 |
| 9 | 0.7240 | 0.6274 | 0.6318 |
| 10 | 0.7035 | 0.6482 | 0.6528 |
| 11 | 0.6818 | 0.6683 | 0.6731 |
| 12 | 0.6767 | 0.6884 | 0.6932 |
| 13 | 0.6238 | 0.7068 | 0.7118 |
| 14 | 0.6085 | 0.7248 | 0.7299 |
| 15 | 0.5866 | 0.7422 | 0.7474 |
| 16 | 0.5413 | 0.7582 | 0.7635 |
| 17 | 0.5106 | 0.7733 | 0.7788 |
| 18 | 0.4790 | 0.7875 | 0.7930 |
| 19 | 0.4694 | 0.8013 | 0.8070 |
| 20 | 0.4529 | 0.8147 | 0.8205 |
| 21 | 0.4305 | 0.8275 | 0.8333 |
| 22 | 0.4174 | 0.8398 | 0.8458 |
| 23 | 0.3975 | 0.8516 | 0.8576 |
| 24 | 0.3724 | 0.8626 | 0.8687 |
| 25 | 0.3646 | 0.8734 | 0.8796 |
| 26 | 0.3507 | 0.8838 | 0.8900 |
| 27 | 0.3468 | 0.8940 | 0.9003 |
| 28 | 0.3305 | 0.9038 | 0.9102 |
| 29 | 0.3176 | 0.9132 | 0.9197 |
| 30 | 0.3063 | 0.9223 | 0.9288 |
| 31 | 0.2882 | 0.9308 | 0.9374 |
| 32 | 0.2757 | 0.9389 | 0.9456 |
| 33 | 0.2565 | 0.9465 | 0.9532 |
| 34 | 0.2354 | 0.9535 | 0.9602 |
| 35 | 0.2182 | 0.9599 | 0.9667 |
| 36 | 0.2139 | 0.9663 | 0.9731 |
| 37 | 0.1903 | 0.9719 | 0.9788 |
| 38 | 0.1717 | 0.9770 | 0.9839 |
| 39 | 0.1688 | 0.9820 | 0.9889 |
| 40 | 0.1459 | 0.9863 | 0.9933 |
| 41 | 0.1206 | 0.9899 | 0.9969 |
| 42 | 0.1055 | 0.9930 | 1.0000 |
| 43 | 0.0663 | 0.9949 | |
| 44 | 0.0533 | 0.9965 | |
| 45 | 0.0450 | 0.9979 | |
| 46 | 0.0350 | 0.9989 | |
| 47 | 0.0237 | 0.9996 | |
| 48 | 0.0091 | 0.9999 | |
| 49 | 0.0046 | 1.0000 | |
| 50 | -0.0055 | | |
| 51 | -0.0277 | | |
| 52 | -0.0399 | | |
| 53 | -0.0508 | | |
| 54 | -0.0791 | | |
| 55 | -0.0883 | | |

## TABLE 5-9

Factor Loading Matrix for the Fifty-Five Items of Test J1 in the J1/1075 Case.

| ITEM | FACTOR 1 | FACTOR 2 | FACTOR 3 | FACTOR 4 | FACTOR 5 | FACTOR 6 | FACTOR 7 |
|---|---|---|---|---|---|---|---|
| J101 | 0.61043 | 0.19598 | -0.05464 | 0.07542 | 0.07286 | -0.18941 | -0.14135 |
| J102 | 0.47598 | -0.10294 | -0.12100 | -0.08564 | -0.00427 | -0.03974 | 0.10686 |
| J103 | 0.54035 | 0.04782 | -0.25590 | 0.02518 | 0.29484 | 0.02543 | -0.25564 |
| J104 | 0.57770 | -0.11864 | 0.00231 | 0.12198 | 0.07184 | -0.03308 | 0.00607 |
| J105 | 0.61634 | -0.12708 | 0.11562 | -0.04205 | -0.03089 | 0.02378 | 0.14063 |
| J106 | 0.44726 | -0.15486 | -0.07819 | 0.05233 | 0.17241 | 0.00990 | 0.30015 ↓ |
| J107 | 0.49329 | -0.12425 | -0.09758 | 0.01361 | 0.09995 | 0.12483 | -0.08452 |
| J108 | 0.63700 | -0.34440 ↓ | -0.16968 | -0.09753 | -0.45234 ↓ | 0.05166 | -0.05187 |
| J109 | 0.31339 | 0.07604 | -0.12758 | -0.11168 | 0.37257 ↓ | -0.10823 | 0.18090 |
| J110 | 0.53911 | -0.19497 | 0.22553 | -0.17537 | 0.28185 | 0.04353 | -0.06265 |
| J111 | 0.70100 | -0.09472 | -0.05455 | -0.07089 | -0.06857 | -0.25146 | -0.08487 |
| J112 | 0.43670 | -0.01963 | -0.24108 | 0.17325 | -0.06594 | -0.16625 | 0.06981 |
| J113 | 0.48428 | -0.08023 | -0.07331 | 0.08558 | -0.03805 | 0.02050 | 0.19791 |
| J114 | 0.53419 | 0.14031 | 0.12352 | 0.08886 | -0.08975 | -0.21592 | 0.00148 |
| J115 | 0.63185 | 0.07652 | -0.12490 | -0.01808 | -0.02749 | 0.05582 | 0.05837 |
| J116 | 0.35899 | -0.08805 | -0.10085 | -0.05841 | -0.08215 | 0.22747 | 0.07647 |
| J117 | 0.33359 | -0.15038 | 0.13042 | 0.08361 | 0.14209 | 0.13210 | 0.10490 |
| J118 | 0.48805 | 0.19061 | -0.15250 | -0.01070 | 0.27958 | 0.15336 | -0.07751 |
| J119 | 0.52329 | -0.06907 | -0.21062 | 0.06751 | 0.06373 | 0.07083 | 0.29423 |
| J120 | 0.28878 | 0.13649 | 0.06027 | 0.13521 | -0.06289 | -0.11481 | 0.10335 |
| J121 | 0.44657 | -0.03185 | -0.01931 | -0.08235 | 0.01485 | 0.02948 | 0.06723 |
| J122 | 0.47122 | 0.01455 | -0.01102 | -0.00421 | 0.05932 | -0.12274 | -0.07499 |
| J123 | 0.46670 | 0.04409 | -0.07771 | -0.06309 | 0.06072 | -0.05100 | -0.17089 |
| J124 | 0.49890 | -0.05324 | -0.23578 | -0.01375 | -0.04186 | 0.15332 | -0.02585 |
| J125 | 0.46241 | -0.19754 | -0.26570 | -0.05983 | 0.16120 | 0.05038 | -0.03056 |
| J126 | 0.42898 | -0.03245 | 0.07570 | 0.02962 | 0.07486 | -0.15596 | -0.09084 |
| J127 | 0.47687 | -0.09154 | -0.32314 ↓ | 0.00752 | -0.04546 | 0.03237 | -0.14351 |
| J128 | 0.61289 | -0.05743 | -0.05556 | 0.00133 | -0.04110 | -0.06901 | -0.23566 |
| J129 | 0.62127 | -0.03373 | 0.20749 | -0.01614 | 0.01439 | 0.30965 ↓ | 0.03696 |
| J130 | 0.33121 | -0.24558 | 0.27901 | 0.07706 | 0.11497 | -0.22906 | 0.03468 |
| J131 | 0.65912 | 0.08031 | -0.16017 | -0.06083 | -0.0[illegible]098 | 0.00190 | 0.13589 |
| J132 | 0.39622 | 0.11709 | 0.02072 | 0.09270 | -0.1[illegible]175 | -0.03400 | 0.07169 |
| J133 | 0.59063 | -0.39896 ↓ | 0.15478 | -0.01710 | -0.2[illegible]000 | -0.09010 | -0.08355 |
| J134 | 0.29280 | 0.17472 | 0.10620 | 0.07367 | 0.0[illegible]350 | -0.02260 | -0.17259 |
| J135 | 0.64151 | -0.15051 | 0.12960 | -0.02264 | 0.0[illegible]544 | 0.19200 | -0.07295 |
| J136 | 0.34499 | -0.04909 | -0.12861 | 0.19779 | -0.0[illegible]179 | -0.09404 | 0.06426 |
| J137 | 0.56344 | 0.07955 | 0.01312 | -0.05585 | -0.0[illegible]771 | 0.11904 | 0.04678 |
| J139 | 0.38553 | 0.13285 | 0.13835 | -0.00844 | 0.0[illegible]118 | 0.24991 | 0.09375 |
| J140 | 0.38741 | 0.30171 ↓ | 0.12788 | -0.62076 ↓ | -0.0[illegible]057 | -0.00318 | 0.04837 |
| J141 | 0.49966 | -0.33105 ↓ | 0.43054 ↓ | 0.03567 | 0.0[illegible]502 | -0.06279 | -0.09764 |
| J142 | 0.44664 | 0.04192 | 0.18276 | 0.12073 | 0.1[illegible]081 | -0.15724 | 0.21457 |
| J143 | 0.57445 | 0.02038 | 0.09103 | -0.04597 | -0.0[illegible]898 | 0.00343 | 0.01080 |
| J144 | 0.36260 | 0.28799 | 0.12820 | -0.54492 ↓ | -0.0[illegible]326 | -0.07702 | 0.00933 |
| J145 | 0.61314 | 0.03202 | -0.06676 | -0.13497 | -0.2[illegible]942 | -0.10460 | 0.17558 |
| J146 | 0.65428 | -0.15909 | 0.05045 | 0.07158 | 0.1[illegible]651 | 0.04996 | -0.12365 |
| J147 | 0.40778 | 0.37189 ↓ | 0.07136 | 0.25840 | -0.0[illegible]069 | 0.07567 | 0.07242 |
| J148 | 0.45427 | 0.21737 | -0.11561 | -0.03423 | -0.0[illegible]966 | 0.06493 | -0.13935 |
| J149 | 0.45706 | 0.03330 | -0.00825 | -0.17993 | -0.0[illegible]596 | -0.09089 | -0.02823 |
| J150 | 0.45803 | 0.03970 | -0.03507 | -0.09321 | -0.0[illegible]019 | -0.04152 | 0.00427 |
| J151 | 0.43711 | 0.27778 | -0.03726 | 0.20683 | -0.1[illegible]853 | -0.22817 | 0.01314 |
| J152 | 0.32579 | 0.26849 | -0.02789 | 0.20620 | -0.1[illegible]235 | 0.07838 | 0.06023 |
| J153 | 0.41996 | 0.07903 | 0.41016 ↓ | 0.09334 | -0.0[illegible]081 | 0.07381 | 0.08552 |
| J154 | 0.21850 | 0.10422 | 0.11416 | 0.18322 | -0.2[illegible]558 | 0.32047 ↓ | -0.16296 |
| J155 | 0.65222 | 0.22260 | 0.13611 | 0.16775 | 0.0[illegible]086 | -0.01223 | -0.20694 |
| J156 | 0.57965 | 0.32560 ↓ | 0.11026 | 0.13656 | 0.0[illegible]438 | 0.09796 | 0.02313 |

## TABLE 5-9 (Continued)

| ITEM | FACTOR 8 | FACTOR 9 | FACTOR 10 | FACTOR 11 | FACTOR 12 | FACTOR 13 | FACTOR 14 |
|---|---|---|---|---|---|---|---|
| J101 | 0.00763 | -0.00051 | -0.03522 | -0.08039 | 0.01240 | -0.00642 | 0.04204 |
| J102 | -0.15886 | 0.25593 | 0.17169 | -0.03037 | -0.04909 | -0.13255 | 0.04312 |
| J103 | -0.03843 | 0.08286 | 0.02414 | -0.11331 | -0.05337 | -0.01341 | 0.05923 |
| J104 | 0.04746 | -0.04592 | 0.05422 | -0.04929 | 0.29107 | -0.09222 | 0.11532 |
| J105 | -0.03021 | 0.01756 | 0.04449 | 0.02040 | 0.13036 | 0.07887 | -0.07228 |
| J106 | 0.06482 | 0.13181 | 0.01592 | -0.20103 | -0.06081 | 0.04698 | 0.06786 |
| J107 | 0.00889 | -0.05946 | -0.02294 | 0.20386 | 0.07183 | 0.03308 | 0.12526 |
| J108 | 0.00554 | 0.05483 | 0.07655 | 0.08379 | -0.15657 | 0.08641 | 0.04770 |
| J109 | 0.08677 | 0.20700 | 0.09128 | 0.12404 | 0.18789 | 0.04689 | -0.09323 |
| J110 | 0.06638 | -0.04436 | -0.05647 | -0.06437 | -0.12554 | -0.04045 | 0.12596 |
| J111 | -0.10491 | 0.09073 | -0.06255 | 0.11389 | 0.00773 | 0.07512 | -0.16961 |
| J112 | -0.16206 | -0.03849 | 0.10444 | -0.09824 | -0.05507 | -0.11130 | -0.04372 |
| J113 | -0.25317 | 0.03674 | -0.04896 | 0.03438 | 0.06900 | 0.12557 | 0.23286 |
| J114 | -0.06060 | 0.03956 | 0.12123 | -0.01037 | 0.07639 | -0.00804 | 0.03485 |
| J115 | 0.13234 | -0.22059 | 0.03884 | 0.07629 | -0.05233 | -0.08098 | -0.01629 |
| J116 | 0.12379 | 0.16273 | 0.02715 | -0.02105 | 0.05664 | 0.00486 | -0.06743 |
| J117 | -0.14093 | 0.08106 | -0.07484 | -0.07269 | -0.06092 | 0.17381 | -0.20435 |
| J118 | -0.25509 | -0.01375 | 0.02197 | 0.25815 | -0.02638 | -0.04137 | 0.01745 |
| J119 | 0.04280 | -0.10076 | -0.13409 | -0.00872 | 0.14772 | 0.02277 | 0.03526 |
| J120 | 0.10949 | -0.14115 | 0.08654 | 0.05337 | 0.08353 | 0.20858 | 0.00575 |
| J121 | 0.02439 | 0.01699 | -0.08103 | 0.01370 | 0.03364 | -0.01897 | -0.05137 |
| J122 | -0.04886 | 0.00382 | 0.07016 | 0.25823 | -0.25539 | 0.20300 | 0.12116 |
| J123 | 0.07169 | -0.04059 | -0.24170 | -0.13459 | -0.04397 | 0.14286 | 0.25507 |
| J124 | 0.16440 | -0.02170 | -0.05092 | 0.12486 | 0.15739 | 0.00774 | -0.24109 |
| J125 | 0.06581 | -0.07428 | 0.26553 | -0.07083 | -0.10840 | -0.03932 | 0.02255 |
| J126 | 0.05148 | -0.06655 | 0.14437 | -0.13544 | 0.09231 | 0.02915 | -0.11531 |
| J127 | 0.01793 | 0.08644 | -0.21217 | -0.00592 | 0.02428 | 0.14433 | -0.07062 |
| J128 | -0.01154 | 0.02382 | 0.17210 | 0.00135 | 0.10136 | 0.00574 | -0.05203 |
| J129 | -0.14557 | -0:17134 | -0.10908 | 0.06521 | -0.14151 | -0.10648 | -0.05821 |
| J130 | 0.12589 | 0.14817 | -0.03379 | 0.02760 | -0.07672 | 0.00240 | -0.12932 |
| J131 | 0.15480 | -0.19684 | -0.02219 | -0.11887 | -0.11863 | 0.05139 | 0.00596 |
| J132 | -0.18168 | -0.11359 | 0.01246 | -0.08165 | -0.10105 | -0.07639 | 0.01383 |
| J133 | -0.23030 | -0.15042 | -0.06192 | 0.03626 | 0.15696 | -0.21655 | 0.00972 |
| J134 | 0.10290 | 0.11907 | 0.02762 | 0.10482 | -0.06879 | -0.22826 | 0.00023 |
| J135 | -0.02801 | 0.06623 | -0.11528 | 0.05560 | 0.00871 | 0.00002 | -0.13188 |
| J136 | 0.05517 | -0.17266 | -0.15034 | 0.16634 | 0.09668 | -0.00722 | 0.07486 |
| J137 | 0.03466 | -0.08286 | 0.04912 | -0.37338 ↓ | -0.01676 | 0.00039 | -0.02903 |
| J139 | -0.02054 | 0.15854 | -0.04602 | -0.12255 | 0.10473 | -0.17746 | 0.15098 |
| J140 | -0.21390 | -0.06442 | 0.00918 | 0.00270 | 0.05406 | 0.12442 | -0.08026 |
| J141 | -0.01994 | 0.07582 | 0.08357 | -0.06801 | -0.00579 | 0.09418 | 0.01231 |
| J142 | 0.04651 | -0.09349 | 0.05061 | 0.04292 | -0.13590 | 0.08597 | 0.05201 |
| J143 | -0.03036 | 0.05158 | 0.06652 | -0.11766 | -0.13964 | -0.03690 | -0.04010 |
| J144 | -0.02819 | -0.02170 | 0.01927 | -0.01353 | 0.16830 | 0.01198 | 0.08245 |
| J145 | 0.19290 | 0.04428 | -0.00444 | 0.04053 | -0.15185 | -0.08222 | -0.06027 |
| J146 | -0.06678 | -0:10346 | -0.01917 | -0.01683 | 0.06681 | -0.09673 | 0.02931 |
| J147 | -0.13325 | -0.11780 | 0.35280 ↓ | 0.11681 | 0.04397 | 0.03586 | -0.01138 |
| J148 | 0.06002 | -0.00689 | -0.00757 | -0.07652 | -0.09852 | -0.00025 | -0.00867 |
| J149 | 0.28899 | 0.16644 | 0.04992 | 0.12518 | 0.02985 | -0.17810 | 0.11637 |
| J150 | 0.02931 | 0.05994 | -0.05824 | 0.06600 | -0.06063 | 0.02506 | 0.08360 |
| J151 | -0.18556 | 0.23518 | -0.34330 ↓ | -0.10102 | 0.03946 | -0.00230 | -0.00504 |
| J152 | -0.00127 | 0.21780 | 0.03088 | 0.02226 | -0.03241 | -0.13385 | -0.00239 |
| J153 | 0.22570 | 0.02197 | -0.10606 | 0.18331 | 0.00466 | -0.00660 | 0.12340 |
| J154 | 0.03886 | 0.24208 | 0.17636 | -0.04213 | 0.09775 | 0.28220 | 0.10525 |
| J155 | 0.16845 | -0.19582 | -0.04034 | -0.14097 | 0.09644 | 0.06087 | -0.10289 |
| J156 | 0.00245 | 0.02689 | -0.11936 | 0.07491 | -0.14164 | -0.04541 | -0.17847 |

TABLE 5-9 (Continued)

| ITEM | FACTOR 15 | FACTOR 16 | FACTOR 17 | FACTOR 18 | FACTOR 19 | FACTOR 20 | FACTOR 21 |
|---|---|---|---|---|---|---|---|
| J101 | -0.05062 | -0.00199 | -0.03897 | 0.11128 | -0.04133 | -0.15403 | -0.07230 |
| J102 | -0.04130 | 0.19733 | -0.03480 | -0.01181 | -0.02851 | -0.01680 | -0.05333 |
| J103 | 0.09212 | 0.18128 | 0.00089 | 0.03122 | -0.05555 | 0.05087 | 0.11975 |
| J104 | -0.03338 | -0.04123 | 0.00203 | -0.05638 | -0.03357 | -0.17535 | 0.13379 |
| J105 | -0.14037 | -0.07260 | -0.13220 | -0.01985 | 0.05232 | -0.15706 | -0.00195 |
| J106 | 0.09626 | -0.03889 | -0.07096 | -0.18814 | -0.07029 | -0.04105 | -0.01104 |
| J107 | 0.04874 | 0.12994 | -0.12659 | 0.04178 | -0.03517 | -0.02776 | -0.16051 |
| J108 | 0.07475 | -0.02123 | -0.03388 | 0.00046 | -0.06175 | -0.10978 | -0.00834 |
| J109 | -0.06954 | -0.11282 | 0.05947 | 0.13835 | 0.00668 | -0.07174 | 0.10184 |
| J110 | -0.05644 | -0.01973 | 0.01546 | 0.03448 | -0.17792 | 0.04698 | -0.08360 |
| J111 | -0.13643 | -0.05985 | 0.03280 | -0.22197 | -0.06769 | 0.10922 | -0.03707 |
| J112 | -0.07060 | 0.00826 | 0.15287 | 0.15405 | -0.10458 | -0.05189 | 0.00955 |
| J113 | 0.02623 | -0.01397 | -0.08573 | 0.16900 | 0.13575 | 0.09279 | -0.05526 |
| J114 | 0.09963 | 0.06482 | 0.17363 | 0.08671 | -0.01497 | -0.05057 | -0.03283 |
| J115 | -0.01829 | -0.05299 | -0.14863 | 0.05522 | -0.06145 | 0.04333 | 0.09697 |
| J116 | 0.17974 | 0.02141 | -0.03847 | -0.14002 | 0.16599 | -0.01286 | 0.04476 |
| J117 | 0.08684 | 0.07699 | -0.01552 | 0.07423 | -0.09521 | 0.08256 | 0.10204 |
| J118 | -0.06923 | -0.06666 | 0.07131 | -0.03824 | 0.05431 | 0.06267 | -0.01881 |
| J119 | 0.00336 | -0.06781 | 0.09422 | -0.14178 | -0.05240 | 0.13538 | -0.11237 |
| J120 | 0.02524 | 0.04044 | 0.13721 | 0.09438 | -0.02245 | 0.25674 | 0.08544 |
| J121 | -0.13012 | 0.12784 | 0.00822 | 0.00235 | 0.11239 | -0.03670 | -0.02888 |
| J122 | -0.04514 | -0.04770 | 0.09318 | -0.16734 | 0.04943 | -0.06330 | -0.00108 |
| J123 | -0.00037 | -0.00868 | 0.12385 | -0.03694 | 0.13202 | 0.01290 | 0.14198 |
| J124 | -0.05216 | 0.05903 | 0.08787 | 0.02692 | -0.03095 | -0.02848 | -0.07838 |
| J125 | 0.23929 | -0.24558 | 0.08867 | 0.02652 | 0.11842 | 0.01677 | -0.08608 |
| J126 | -0.04459 | -0.16033 | -0.23322 | -0.07250 | 0.06083 | 0.16590 | -0.00261 |
| J127 | 0.06165 | 0.09279 | -0.08667 | 0.05662 | -0.02881 | 0.04726 | -0.11826 |
| J128 | -0.08070 | 0.02553 | -0.12028 | 0.02936 | -0.01885 | 0.00299 | 0.08564 |
| J129 | 0.02442 | 0.01840 | 0.08458 | 0.01980 | -0.03647 | -0.11159 | 0.06874 |
| J130 | 0.12194 | 0.11812 | 0.04375 | 0.08529 | 0.08154 | -0.00997 | -0.12145 |
| J131 | -0.11469 | 0.07279 | 0.09602 | 0.04084 | 0.11319 | -0.05137 | -0.05448 |
| J132 | -0.00066 | -0.10102 | 0.01005 | -0.07709 | 0.00556 | 0.04812 | -0.00063 |
| J133 | 0.08184 | 0.00375 | 0.00334 | 0.04542 | 0.16224 | 0.08663 | 0.00975 |
| J134 | -0.03343 | 0.04124 | -0.03817 | -0.16583 | 0.03641 | 0.08373 | 0.03709 |
| J135 | 0.09273 | -0.09860 | 0.11333 | -0.02856 | -0.01604 | 0.03340 | 0.15555 |
| J136 | -0.01615 | 0.19967 | -0.06026 | -0.05054 | -0.04862 | 0.04820 | 0.15351 |
| J137 | -0.21065 | 0.13193 | 0.08480 | -0.13860 | -0.06254 | 0.02249 | -0.05117 |
| J139 | -0.07393 | 0.00589 | -0.01702 | 0.06971 | 0.12448 | 0.05832 | -0.00677 |
| J140 | 0.08436 | 0.12097 | -0.03622 | -0.03775 | -0.02965 | -0.06160 | 0.01891 |
| J141 | -0.09080 | 0.02847 | 0.10199 | 0.03788 | 0.02206 | 0.05770 | -0.03335 |
| J142 | 0.06016 | 0.16511 | -0.19030 | -0.03282 | 0.05640 | -0.03019 | 0.05056 |
| J143 | -0.00453 | -0.00822 | -0.09797 | 0.02633 | 0.03900 | 0.05304 | 0.12199 |
| J144 | 0.15265 | -0.04143 | 0.02538 | 0.01929 | -0.07526 | 0.07319 | -0.04784 |
| J145 | -0.03540 | -0.11393 | 0.04105 | 0.14884 | -0.03698 | 0.02298 | 0.09747 |
| J146 | -0.04995 | -0.09008 | 0.01419 | -0.00857 | -0.15864 | -0.02504 | -0.04961 |
| J147 | 0.05158 | 0.04984 | 0.01126 | -0.11080 | 0.00411 | -0.03457 | -0.06979 |
| J148 | -0.05122 | -0.07585 | -0.17177 | 0.13695 | -0.02493 | 0.11037 | -0.10698 |
| J149 | -0.03081 | 0.10462 | 0.10277 | -0.07149 | 0.08409 | 0.06196 | -0.02294 |
| J150 | -0.03142 | -0.11115 | -0.09363 | 0.03685 | -0.01672 | -0.09503 | 0.12667 |
| J151 | 0.06003 | -0.15763 | -0.01095 | -0.07677 | -0.00225 | -0.07024 | -0.04579 |
| J152 | 0.20528 | 0.05950 | 0.00459 | 0.00625 | -0.17568 | 0.07703 | 0.02788 |
| J153 | 0.01334 | -0.11038 | -0.04599 | 0.02525 | -0.16714 | -0.01085 | -0.09557 |
| J154 | -0.12390 | -0.04717 | 0.05091 | 0.03739 | -0.00548 | 0.00475 | 0.02204 |
| J155 | 0.24915 | 0.01805 | 0.01818 | -0.03320 | 0.06334 | -0.13960 | -0.04122 |
| J156 | -0.10249 | -0.01657 | -0.01129 | 0.07986 | 0.20171 | -0.00543 | -0.05941 |

TABLE 5-9 (Continued)

| ITEM | FACTOR 22 | FACTOR 23 | FACTOR 24 | FACTOR 25 | FACTOR 26 | FACTOR 27 | FACTOR 28 |
|---|---|---|---|---|---|---|---|
| J101 | -0.01051 | 0.13638 | 0.06865 | -0.02555 | 0.03706 | -0.15833 | -0.13576 |
| J102 | -0.10832 | -0.09979 | 0.09154 | -0.08661 | 0.11990 | -0.10792 | -0.06194 |
| J103 | 0.03894 | 0.00349 | 0.01832 | -0.03525 | 0.00479 | 0.07004 | 0.03360 |
| J104 | -0.13667 | -0.02174 | -0.09058 | 0.02778 | -0.01904 | -0.05733 | 0.09109 |
| J105 | 0.04154 | -0.09691 | -0.08012 | 0.00673 | 0.13662 | 0.07309 | 0.05648 |
| J106 | 0.12566 | -0.00054 | -0.01153 | 0.05996 | -0.10227 | -0.08919 | -0.09816 |
| J107 | -0.14363 | -0.09493 | -0.01074 | 0.01064 | -0.07225 | -0.00859 | 0.00935 |
| J108 | -0.01158 | -0.05849 | 0.12613 | 0.05553 | 0.06422 | 0.03630 | 0.00411 |
| J109 | 0.01313 | 0.02589 | 0.04315 | 0.02256 | 0.01176 | 0.02618 | 0.06765 |
| J110 | 0.02766 | -0.06745 | 0.00399 | -0.07815 | -0.05328 | 0.00849 | 0.06236 |
| J111 | 0.02217 | -0.02197 | -0.04344 | -0.09975 | -0.01419 | 0.03435 | -0.01988 |
| J112 | 0.23039 | -0.01275 | 0.03401 | 0.08553 | -0.07301 | 0.03676 | 0.04444 |
| J113 | 0.01333 | 0.10903 | -0.01853 | 0.02566 | -0.05779 | -0.02626 | -0.01626 |
| J114 | -0.06683 | -0.12053 | -0.03099 | 0.08491 | 0.04048 | 0.03467 | -0.02506 |
| J115 | 0.07334 | -0.01885 | 0.09031 | -0.14512 | 0.09230 | -0.00209 | -0.02164 |
| J116 | 0.08680 | 0.04077 | -0.02773 | -0.11105 | -0.03640 | 0.04781 | -0.01309 |
| J117 | 0.01500 | -0.09295 | -0.05874 | 0.03084 | 0.00127 | -0.06690 | 0.00054 |
| J118 | 0.04463 | -0.07044 | -0.11299 | 0.02577 | -0.00270 | -0.00679 | -0.13735 |
| J119 | -0.04739 | 0.04505 | 0.06891 | 0.03166 | 0.00527 | 0.01479 | -0.03235 |
| J120 | -0.11067 | -0.01120 | 0.01096 | -0.12523 | 0.07759 | 0.00113 | -0.05842 |
| J121 | -0.01629 | 0.09678 | 0.02093 | 0.10019 | 0.12788 | -0.01392 | -0.10222 |
| J122 | 0.05493 | -0.02275 | -0.04130 | -0.04128 | 0.02771 | -0.06855 | 0.13665 |
| J123 | -0.05766 | -0.05217 | 0.02443 | 0.07085 | 0.03797 | -0.06209 | 0.04690 |
| J124 | -0.01163 | 0.04290 | 0.11130 | -0.00812 | -0.05444 | -0.11633 | 0.09818 |
| J125 | -0.02846 | 0.01437 | -0.06876 | 0.00155 | 0.06308 | 0.08749 | -0.04722 |
| J126 | -0.04099 | -0.02683 | 0.00623 | 0.17986 | 0.00074 | -0.05391 | 0.03693 |
| J127 | -0.02223 | 0.06277 | -0.11607 | 0.01581 | -0.01516 | -0.03723 | 0.04521 |
| J128 | 0.02121 | 0.12316 | -0.20181 | -0.09431 | -0.00087 | 0.02940 | -0.02533 |
| J129 | -0.11456 | 0.15088 | -0.11523 | 0.09026 | 0.02154 | 0.03743 | -0.04782 |
| J130 | 0.07788 | 0.05507 | -0.03215 | 0.03609 | 0.12788 | 0.03859 | -0.01058 |
| J131 | 0.03322 | 0.02983 | -0.06818 | -0.09669 | 0.04899 | 0.00468 | 0.06810 |
| J132 | 0.07270 | 0.10188 | -0.00432 | 0.07289 | 0.08460 | -0.10283 | 0.10911 |
| J133 | 0.05171 | -0.00646 | 0.00479 | -0.08481 | -0.08257 | -0.05082 | 0.03229 |
| J134 | 0.01281 | 0.08262 | 0.05769 | 0.04702 | 0.04036 | 0.01161 | -0.06436 |
| J135 | -0.06108 | -0.02052 | 0.18606 | 0.05265 | 0.06143 | -0.01313 | 0.00385 |
| J136 | 0.18575 | -0.08353 | -0.01956 | 0.11423 | 0.03221 | 0.06933 | -0.06477 |
| J137 | -0.05000 | 0.00147 | -0.04672 | -0.02236 | -0.02303 | 0.04391 | -0.02132 |
| J139 | 0.09012 | -0.14164 | 0.02192 | -0.09285 | 0.06251 | 0.04035 | 0.04870 |
| J140 | 0.03561 | -0.05589 | -0.00829 | 0.05654 | -0.05428 | 0.05801 | .00143 |
| J141 | 0.03495 | 0.02721 | 0.07859 | -0.02178 | -0.11491 | 0.00773 | .03015 |
| J142 | -0.10193 | 0.14509 | 0.10046 | -0.00865 | -0.05412 | 0.14777 | 0.06679 |
| J143 | -0.09093 | -0.03561 | -0.05130 | 0.00893 | 0.00847 | -0.12425 | 0.01760 |
| J144 | 0.07926 | 0.14303 | 0.03803 | -0.00281 | 0.04455 | -0.03356 | 0.02179 |
| J145 | -0.12794 | -0.06295 | -0.10841 | 0.00983 | -0.15107 | 0.01884 | -0.09089 |
| J146 | -0.03521 | 0.09751 | 0.07949 | -0.00901 | 0.00794 | 0.14645 | 0.01466 |
| J147 | -0.04800 | -0.05604 | 0.08551 | -0.00761 | -0.07261 | -0.02572 | 0.00759 |
| J148 | -0.00024 | -0.11075 | 0.06406 | 0.12654 | 0.02167 | 0.07904 | 0.02914 |
| J149 | -0.01438 | -0.00217 | -0.03369 | 0.12769 | -0.09856 | 0.02456 | 0.03106 |
| J150 | 0.05664 | 0.04410 | 0.11569 | -0.07786 | -0.10720 | -0.02955 | -0.07884 |
| J151 | -0.10969 | -0.03962 | 0.01355 | -0.08057 | 0.00473 | 0.13234 | -0.00724 |
| J152 | -0.00638 | 0.08878 | -0.08873 | -0.01497 | 0.00832 | -0.02570 | 0.13529 |
| J153 | 0.08491 | -0.04128 | -0.11269 | -0.00952 | 0.06168 | -0.06595 | -0.01928 |
| J154 | 0.07023 | 0.09519 | 0.01443 | 0.04500 | -0.01210 | 0.05018 | -0.03712 |
| J155 | 0.08746 | -0.11461 | 0.00721 | -0.03737 | -0.03963 | -0.03471 | -0.06801 |
| J156 | 0.02028 | -0.00748 | 0.04518 | -0.01220 | -0.10221 | -0.01166 | 0.05329 |

## TABLE 5-9 (Continued)

| ITEM | FACTOR 29 | FACTOR 30 | FACTOR 31 | FACTOR 32 | FACTOR 33 | FACTOR 34 | FACTOR 35 |
|---|---|---|---|---|---|---|---|
| J101 | 0.00461 | 0.06086 | -0.06572 | -0.01929 | -0.03663 | -0.03935 | -0.02763 |
| J102 | 0.06101 | -0.01381 | 0.01346 | 0.04512 | -0.00286 | 0.03731 | 0.02358 |
| J103 | -0.02162 | 0.01588 | -0.05148 | 0.09074 | -0.01254 | 0.00244 | -0.01502 |
| J104 | 0.10508 | -0.05639 | -0.02724 | 0.02173 | 0.01886 | 0.10068 | -0.02201 |
| J105 | -0.10245 | -0.03358 | 0.01751 | 0.05835 | -0.05113 | -0.02419 | -0.01858 |
| J106 | -0.08512 | -0.03019 | -0.07976 | 0.01689 | -0.00324 | -0.03228 | -0.03429 |
| J107 | -0.11491 | 0.07982 | -0.00961 | 0.03667 | 0.09194 | -0.00303 | -0.04786 |
| J108 | 0.01454 | -0.01378 | -0.05306 | -0.00043 | 0.04011 | 0.00331 | 0.01647 |
| J109 | -0.00435 | 0.13227 | 0.00491 | -0.00855 | 0.03521 | -0.00775 | -0.00609 |
| J110 | 0.00503 | -0.00365 | -0.04984 | -0.02666 | -0.08517 | 0.02102 | 0.04587 |
| J111 | 0.00589 | 0.05212 | -0.03010 | -0.10435 | -0.02282 | -0.00314 | -0.05238 |
| J112 | -0.00065 | -0.05064 | 0.05710 | 0.02859 | -0.03253 | -0.00309 | -0.05955 |
| J113 | -0.00676 | -0.07473 | -0.03430 | -0.05190 | -0.02437 | 0.01946 | 0.00414 |
| J114 | -0.01105 | 0.09848 | -0.03668 | -0.05319 | -0.05829 | -0.06076 | 0.04062 |
| J115 | 0.05877 | -0.00846 | -0.09386 | -0.03223 | 0.00244 | -0.00264 | -0.03017 |
| J116 | -0.01961 | 0.14298 | 0.02248 | 0.01035 | -0.05280 | 0.05404 | 0.00971 |
| J117 | 0.06013 | -0.04865 | 0.07224 | 0.06570 | 0.02986 | -0.01677 | 0.02016 |
| J118 | 0.02172 | -0.05288 | 0.06193 | -0.05440 | -0.01151 | 0.05113 | 0.01040 |
| J119 | 0.02086 | 0.03051 | 0.01471 | 0.08471 | -0.05378 | -0.03363 | 0.00610 |
| J120 | -0.05933 | -0.02822 | -0.01813 | 0.07583 | 0.00935 | -0.01809 | 0.00381 |
| J121 | 0.02242 | -0.00834 | 0.01422 | -0.03374 | -0.02615 | 0.02609 | 0.07216 |
| J122 | 0.02841 | -0.05300 | -0.03571 | 0.04331 | -0.00406 | -0.01495 | 0.01853 |
| J123 | -0.08283 | 0.02884 | 0.04883 | 0.00295 | 0.00306 | -0.00010 | -0.01044 |
| J124 | 0.04423 | -0.07269 | 0.05737 | 0.00341 | 0.03013 | -0.04410 | 0.00457 |
| J125 | 0.08816 | -0.00255 | 0.02396 | -0.02773 | 0.08790 | -0.03308 | -0.00097 |
| J126 | 0.00553 | -0.02195 | -0.06057 | -0.00176 | -0.02731 | 0.02646 | 0.05002 |
| J127 | 0.06291 | -0.01585 | 0.00755 | -0.03104 | -0.01960 | -0.01691 | 0.00947 |
| J128 | -0.00800 | -0.01725 | -0.00041 | 0.04304 | -0.00027 | -0.07372 | 0.03053 |
| J129 | 0.04596 | 0.04380 | -0.04544 | 0.04093 | -0.03237 | -0.02835 | -0.03644 |
| J130 | -0.11572 | -0.05758 | 0.01108 | 0.00988 | 0.04222 | 0.05322 | -0.01787 |
| J131 | -0.01416 | 0.01515 | 0.04825 | -0.01506 | -0.05945 | 0.07378 | -0.00722 |
| J132 | 0.01159 | 0.10496 | 0.00154 | 0.07007 | 0.07079 | -0.02244 | 0.05172 |
| J133 | -0.04416 | 0.04109 | 0.02650 | 0.04338 | -0.04081 | -0.01013 | -0.01847 |
| J134 | -0.00838 | -0.04216 | 0.04254 | 0.11739 | -0.00471 | 0.01329 | -0.03843 |
| J135 | -0.03055 | -0.03138 | -0.03250 | -0.07681 | -0.05806 | -0.00145 | -0.02723 |
| J136 | 0.04224 | 0.04869 | -0.02769 | -0.06331 | 0.09049 | 0.02638 | 0.01605 |
| J137 | -0.02759 | 0.01475 | 0.02370 | -0.04230 | 0.09492 | -0.00032 | 0.00115 |
| J139 | 0.04978 | -0.05880 | -0.03804 | -0.03107 | 0.02684 | -0.08328 | 0.01083 |
| J140 | 0.00336 | 0.00613 | -0.02468 | 0.03814 | -0.00100 | -0.01872 | 0.01741 |
| J141 | 0.15411 | 0.08987 | 0.00343 | 0.01420 | 0.05353 | 0.04181 | 0.00347 |
| J142 | 0.10185 | -0.03506 | 0.06099 | -0.04789 | -0.03250 | -0.04049 | -0.02284 |
| J143 | -0.06230 | 0.00911 | 0.11016 | -0.12579 | 0.04234 | -0.03311 | -0.06891 |
| J144 | 0.00871 | -0.06270 | 0.00211 | -0.00357 | 0.06166 | 0.05557 | -0.04795 |
| J145 | -0.03124 | -0.04256 | -0.04491 | 0.05180 | -0.00431 | 0.04780 | 0.01581 |
| J146 | -0.15596 | -0.05650 | 0.03199 | -0.03940 | 0.04048 | 0.00625 | 0.06126 |
| J147 | -0.05462 | 0.00090 | 0.04398 | -0.01643 | -0.02097 | 0.02211 | -0.00464 |
| J148 | 0.04314 | 0.07890 | 0.07807 | 0.04447 | -0.06313 | 0.03702 | -0.03347 |
| J149 | 0.02624 | -0.05472 | 0.00956 | -0.01673 | -0.02138 | -0.07300 | 0.00655 |
| J150 | -0.05010 | 0.01542 | 0.14525 | 0.01549 | 0.02183 | -0.00946 | 0.08977 |
| J151 | 0.06669 | -0.03258 | 0.01920 | 0.03695 | 0.04181 | 0.00572 | -0.01139 |
| J152 | -0.04483 | 0.02723 | -0.01810 | -0.07676 | -0.02399 | 0.04356 | 0.05115 |
| J153 | 0.04606 | 0.04618 | 0.07894 | 0.01555 | 0.01015 | -0.01645 | -0.01739 |
| J154 | -0.00280 | -0.01587 | -0.02509 | 0.00512 | -0.01380 | 0.01462 | -0.02879 |
| J155 | 0.03604 | -0.06401 | 0.01391 | -0.01167 | -0.02195 | 0.00057 | 0.02771 |
| J156 | -0.04575 | 0.00534 | -0.14002 | 0.01836 | 0.08296 | 0.01456 | 0.01260 |

TABLE 5-9 (Continued)

| ITEM | FACTOR 36 | FACTOR 37 | FACTOR 38 | FACTOR 39 | FACTOR 40 | FACTOR 41 | FACTOR 42 |
|---|---|---|---|---|---|---|---|
| J101 | 0.05383 | -0.00447 | 0.00980 | 0.01487 | 0.00900 | -0.00686 | 0.03567 |
| J102 | -0.02005 | 0.02179 | 0.00368 | 0.00610 | -0.00606 | -0.00391 | -0.07787 |
| J103 | 0.03437 | -0.02104 | -0.00415 | -0.00999 | -0.04800 | -0.03668 | 0.02030 |
| J104 | -0.02015 | -0.00887 | 0.00556 | -0.00791 | -0.01130 | 0.00438 | -0.03008 |
| J105 | 0.05027 | -0.00726 | -0.00351 | -0.00125 | -0.02193 | -0.07189 | 0.01375 |
| J106 | -0.01704 | 0.01468 | 0.00769 | -0.01533 | 0.00097 | 0.01841 | -0.01339 |
| J107 | -0.00368 | 0.01785 | -0.01333 | -0.01218 | 0.00525 | 0.01583 | 0.03258 |
| J108 | 0.01511 | 0.00717 | -0.00121 | 0.00789 | 0.01085 | -0.01292 | 0.05650 |
| J109 | -0.01854 | 0.02139 | 0.00510 | 0.01405 | 0.03537 | 0.03075 | 0.03192 |
| J110 | -0.01156 | 0.00497 | -0.00386 | 0.00387 | -0.00358 | 0.02987 | 0.00476 |
| J111 | 0.04390 | 0.01384 | 0.00198 | -0.00182 | -0.05139 | 0.02929 | -0.00724 |
| J112 | -0.01571 | -0.01765 | -0.00755 | -0.01177 | 0.00590 | 0.01350 | 0.02132 |
| J113 | 0.03470 | -0.02642 | -0.00208 | 0.00770 | 0.01340 | 0.02070 | -0.06764 |
| J114 | -0.00079 | -0.02737 | -0.00052 | -0.00559 | 0.01822 | -0.03621 | -0.05572 |
| J115 | -0.06229 | -0.02740 | -0.00209 | 0.01618 | -0.01698 | -0.02595 | 0.00164 |
| J116 | 0.00157 | -0.04294 | 0.01145 | -0.00479 | 0.00882 | -0.00082 | -0.01892 |
| J117 | -0.00563 | -0.00781 | 0.01139 | 0.02911 | -0.00744 | 0.00727 | 0.05312 |
| J118 | 0.00842 | 0.01214 | 0.00181 | -0.00115 | -0.00765 | -0.05702 | 0.00101 |
| J119 | -0.04101 | 0.00614 | -0.02323 | 0.01522 | 0.00434 | -0.03258 | -0.00731 |
| J120 | 0.00853 | 0.00656 | 0.01172 | -0.01962 | 0.00506 | 0.00377 | 0.00012 |
| J121 | -0.04608 | -0.02957 | -0.01198 | -0.01787 | -0.03842 | 0.07374 | 0.09011 |
| J122 | -0.01684 | -0.01524 | 0.00417 | -0.00201 | 0.04088 | 0.03733 | -0.01056 |
| J123 | 0.01762 | -0.01277 | -0.00258 | 0.01582 | -0.03192 | 0.02301 | 0.00410 |
| J124 | 0.07575 | -0.01404 | -0.00319 | -0.00410 | -0.02170 | 0.02360 | -0.06820 |
| J125 | 0.03222 | -0.00524 | -0.00388 | 0.00510 | -0.01174 | 0.02536 | -0.00589 |
| J126 | 0.04660 | 0.00605 | -0.00141 | 0.00188 | 0.01638 | -0.00841 | 0.02731 |
| J127 | -0.03724 | -0.00802 | 0.01504 | -0.01574 | 0.04585 | -0.05510 | 0.04665 |
| J128 | -0.05759 | 0.01205 | -0.01167 | -0.00304 | 0.01310 | 0.04717 | -0.03038 |
| J129 | 0.02479 | 0.02644 | 0.01001 | -0.00157 | -0.00426 | 0.01207 | -0.00830 |
| J130 | -0.01193 | 0.01274 | 0.00237 | 0.00336 | -0.01534 | 0.01075 | -0.03285 |
| J131 | 0.01360 | 0.04054 | -0.00441 | 0.00247 | 0.03891 | -0.02196 | 0.02155 |
| J132 | -0.01768 | 0.01873 | 0.00422 | -0.01665 | -0.03221 | -0.02576 | -0.01941 |
| J133 | -0.01112 | 0.01156 | 0.00705 | 0.01516 | -0.00175 | 0.02658 | 0.02864 |
| J134 | 0.04452 | -0.01570 | -0.00831 | 0.00716 | 0.07041 | 0.00717 | 0.00217 |
| J135 | -0.02441 | 0.00944 | -0.00114 | -0.01965 | 0.03373 | 0.00755 | -0.01961 |
| J136 | 0.02028 | 0.01569 | 0.00244 | 0.00412 | 0.02048 | 0.01279 | -0.02587 |
| J137 | 0.01712 | -0.01840 | 0.00945 | 0.00899 | 0.02451 | 0.01510 | -0.01212 |
| J139 | 0.04863 | 0.01734 | 0.00346 | -0.01567 | 0.01803 | 0.02619 | 0.05179 |
| J140 | 0.00593 | -0.01013 | -0.01029 | 0.00562 | 0.01657 | 0.01832 | -0.03391 |
| J141 | 0.01186 | -0.00725 | -0.01172 | -0.01053 | 0.01183 | -0.05103 | 0.02378 |
| J142 | 0.01848 | 0.00878 | 0.00124 | -0.00326 | -0.01794 | -0.00566 | -0.00610 |
| J143 | -0.04686 | -0.01201 | -0.01576 | -0.00282 | 0.01320 | -0.02820 | -0.00981 |
| J144 | -0.00988 | 0.00470 | 0.00546 | -0.00686 | -0.00758 | -0.01952 | 0.03026 |
| J145 | 0.02920 | -0.00801 | -0.00224 | -0.00503 | -0.00574 | 0.00977 | 0.02139 |
| J146 | -0.02261 | -0.01963 | 0.01363 | 0.00702 | 0.01619 | -0.01753 | -0.02323 |
| J147 | -0.01535 | -0.01184 | 0.01030 | 0.00170 | -0.01187 | 0.02886 | 0.08808 |
| J148 | -0.02239 | 0.01025 | 0.01470 | -0.00592 | -0.00914 | 0.05138 | -0.06199 |
| J149 | -0.04916 | 0.01278 | 0.01470 | 0.01291 | -0.03189 | -0.04281 | 0.01860 |
| J150 | 0.01847 | 0.02190 | 0.00212 | -0.01103 | -0.01011 | -0.02115 | -0.01432 |
| J151 | -0.02609 | -0.00013 | -0.00253 | 0.00128 | 0.00358 | 0.01467 | 0.02631 |
| J152 | 0.04472 | 0.01674 | -0.01504 | 0.01010 | -0.00543 | 0.00774 | 0.02184 |
| J153 | 0.00862 | -0.03518 | -0.00012 | -0.00200 | -0.00948 | 0.01099 | -0.00892 |
| J154 | -0.02704 | 0.02648 | -0.00498 | 0.01243 | -0.02276 | 0.00029 | -0.01892 |
| J155 | -0.01695 | 0.02969 | -0.00762 | 0.00192 | -0.00099 | 0.00354 | -0.01813 |
| J156 | -0.03715 | -0.01099 | -0.00170 | 0.00494 | -0.01509 | -0.02264 | -0.03299 |

TABLE 5-9 (Continued)

| ITEM | FACTOR 43 | FACTOR 44 | FACTOR 45 | FACTOR 46 | FACTOR 47 | FACTOR 48 | FACTOR 49 |
|---|---|---|---|---|---|---|---|
| J101 | 0.03967 | -0.01468 | 0.04098 | -0.09454 | 0.03327 | -0.03316 | 0.07816 |
| J102 | -0.04116 | -0.01887 | 0.05606 | -0.03741 | 0.04166 | 0.09662 | -0.04559 |
| J103 | -0.03185 | 0.01825 | -0.09033 | -0.03375 | -0.01189 | 0.04329 | 0.02678 |
| J104 | 0.04340 | -0.00964 | -0.01872 | 0.02991 | -0.02790 | -0.00075 | 0.02352 |
| J105 | -0.07573 | -0.06095 | 0.04883 | 0.00955 | 0.06070 | -0.05130 | 0.00092 |
| J106 | 0.01135 | 0.03546 | 0.02439 | 0.00028 | -0.06139 | -0.01301 | -0.08902 |
| J107 | 0.00929 | 0.06567 | -0.03147 | -0.00550 | 0.05928 | -0.02305 | 0.05237 |
| J108 | 0.04796 | -0.04527 | -0.02204 | -0.00543 | -0.06320 | -0.03656 | 0.04041 |
| J109 | -0.05670 | 0.01173 | 0.00395 | 0.04500 | -0.04553 | 0.00482 | 0.05617 |
| J110 | 0.02840 | -0.12679 | -0.04172 | 0.04508 | -0.01719 | -0.01967 | 0.09785 |
| J111 | -0.02615 | -0.01353 | -0.02827 | 0.04093 | -0.05396 | 0.02832 | -0.00904 |
| J112 | 0.02625 | -0.00570 | 0.03827 | 0.00360 | 0.08596 | 0.07878 | 0.03475 |
| J113 | -0.08318 | -0.01525 | -0.08402 | 0.02019 | -0.04218 | -0.00704 | 0.05388 |
| J114 | 0.05083 | 0.02419 | -0.08272 | 0.06995 | -0.00915 | -0.08386 | -0.08482 |
| J115 | -0.00270 | 0.11454 | -0.00688 | 0.11560 | -0.01509 | -0.00595 | -0.04904 |
| J116 | 0.06862 | -0.02714 | 0.02758 | -0.03430 | 0.02945 | -0.01107 | 0.09162 |
| J117 | 0.02193 | 0.00235 | -0.06264 | -0.04128 | -0.00311 | -0.07324 | -0.00683 |
| J118 | 0.05866 | 0.05967 | 0.03641 | -0.02768 | -0.00907 | -0.08797 | 0.04517 |
| J119 | 0.03065 | -0.03730 | 0.02167 | 0.01571 | 0.03568 | -0.04076 | -0.00324 |
| J120 | 0.02585 | -0.03668 | 0.04992 | 0.01480 | 0.01015 | 0.07868 | 0.09087 |
| J121 | -0.01741 | 0.01444 | 0.00654 | 0.01740 | 0.00730 | 0.00730 | 0.03545 |
| J122 | 0.00149 | 0.04494 | 0.04470 | 0.02338 | 0.10016 | -0.03543 | 0.05126 |
| J123 | 0.00317 | -0.00392 | 0.09064 | 0.01421 | -0.03041 | -0.00356 | -0.14452 |
| J124 | 0.04768 | 0.00912 | 0.00027 | 0.01104 | -0.05361 | -0.02614 | -0.01633 |
| J125 | -0.02591 | -0.03661 | -0.00137 | -0.01793 | 0.03734 | 0.06656 | -0.03456 |
| J126 | 0.06048 | 0.04526 | -0.02560 | -0.00006 | 0.08225 | 0.11737 | -0.00670 |
| J127 | -0.04749 | -0.01741 | 0.04506 | 0.08804 | -0.03153 | 0.06209 | -0.06599 |
| J128 | 0.02203 | -0.03992 | -0.01260 | -0.08900 | -0.00099 | -0.09363 | -0.11699 |
| J129 | 0.01425 | -0.02932 | 0.00959 | 0.11305 | 0.03481 | 0.08116 | -0.02938 |
| J130 | 0.05634 | 0.04182 | -0.01875 | 0.08181 | -0.01575 | -0.02079 | -0.00466 |
| J131 | 0.02279 | 0.03474 | -0.10097 | -0.10025 | -0.07405 | 0.06246 | -0.07642 |
| J132 | -0.03436 | 0.02465 | -0.02948 | -0.03046 | -0.11675 | -0.06053 | 0.11022 |
| J133 | -0.00828 | 0.05184 | 0.01661 | 0.00295 | 0.03718 | 0.01218 | 0.00314 |
| J134 | -0.03248 | -0.03096 | -0.03674 | 0.07632 | -0.09120 | -0.02364 | 0.00428 |
| J135 | -0.05981 | 0.02893 | -0.06157 | -0.13013 | 0.07908 | -0.02942 | -0.02890 |
| J136 | 0.00090 | -0.08752 | 0.01253 | -0.04172 | 0.02396 | 0.01290 | -0.01038 |
| J137 | -0.04886 | 0.05182 | -0.04247 | 0.04102 | 0.13360 | -0.06758 | 0.05159 |
| J139 | 0.04992 | 0.01861 | 0.03457 | 0.02546 | -0.05084 | -0.02219 | -0.01741 |
| J140 | 0.01846 | 0.04993 | 0.03965 | -0.02348 | -0.07625 | 0.13063 | 0.02503 |
| J141 | -0.02777 | 0.01835 | 0.08077 | -0.00122 | -0.03233 | -0.02393 | -0.07554 |
| J142 | 0.01869 | 0.03079 | 0.04107 | -0.05189 | 0.01381 | -0.06124 | 0.01891 |
| J143 | 0.03831 | -0.06934 | 0.01930 | 0.02828 | -0.05182 | 0.04480 | 0.10928 |
| J144 | 0.01105 | -0.06244 | -0.01595 | -0.00209 | 0.07664 | -0.10303 | -0.06403 |
| J145 | -0.04011 | 0.03124 | 0.04624 | -0.03349 | -0.05082 | -0.08281 | 0.01236 |
| J146 | 0.00383 | 0.02570 | 0.08304 | -0.06616 | -0.09719 | 0.05261 | 0.00198 |
| J147 | -0.02344 | -0.06773 | -0.03367 | 0.01428 | -0.06476 | 0.01499 | -0.11870 |
| J148 | -0.00509 | -0.00498 | 0.04282 | 0.00967 | 0.00041 | -0.09083 | -0.02084 |
| J149 | -0.02393 | 0.00388 | -0.03481 | -0.04348 | 0.02212 | 0.04693 | 0.06643 |
| J150 | 0.01418 | -0.00461 | -0.07884 | 0.12076 | 0.09868 | 0.04591 | -0.05125 |
| J151 | 0.03486 | 0.00698 | -0.04201 | -0.01860 | 0.00876 | 0.03999 | 0.02428 |
| J152 | -0.02010 | 0.03225 | 0.08706 | 0.01963 | 0.06624 | -0.01318 | -0.02930 |
| J153 | -0.02442 | 0.03352 | -0.03887 | -0.10427 | 0.00833 | 0.12481 | -0.03722 |
| J154 | 0.02488 | 0.03578 | -0.00507 | 0.02548 | -0.00933 | 0.05268 | 0.04737 |
| J155 | -0.08756 | -0.00218 | 0.03694 | 0.03842 | -0.02128 | -0.02036 | 0.11439 |
| J156 | 0.01180 | -0.09271 | 0.00200 | -0.03976 | 0.05506 | 0.03536 | -0.06906 |

TABLE 5-9 (Continued)

| ITEM | FACTOR 50 | FACTOR 51 | FACTOR 52 | FACTOR 53 | FACTOR 54 | FACTOR 55 |
|---|---|---|---|---|---|---|
| J101 | 0.03142 | 0.08503 | -0.08541 | 0.03466 | -0.04517 | 0.07272 |
| J102 | 0.02207 | 0.01248 | 0.07447 | -0.05042 | 0.02570 | -0.11835 |
| J103 | -0.11117 | -0.01416 | 0.06125 | 0.11280 | -0.13397 | -0.03643 |
| J104 | -0.04373 | 0.05862 | -0.13490 | 0.08246 | 0.08054 | 0.06797 |
| J105 | 0.05133 | -0.00373 | 0.02756 | -0.02744 | -0.00589 | 0.12547 |
| J106 | -0.04144 | -0.08182 | 0.08166 | 0.00424 | 0.04386 | 0.14398 |
| J107 | 0.04660 | 0.05344 | -0.01937 | -0.15265 | 0.07909 | -0.00817 |
| J108 | -0.08513 | -0.18616 | -0.06582 | 0.08115 | 0.05689 | -0.05921 |
| J109 | -0.02641 | -0.10130 | 0.05861 | 0.04389 | 0.01260 | -0.08387 |
| J110 | 0.15721 | -0.01742 | 0.08529 | 0.02682 | 0.05081 | 0.03369 |
| J111 | -0.08266 | 0.07870 | -0.09197 | -0.05516 | 0.09025 | -0.07117 |
| J112 | 0.05415 | -0.01380 | -0.06075 | -0.08624 | 0.10397 | -0.10237 |
| J113 | -0.01280 | -0.06726 | -0.07862 | -0.08339 | -0.05319 | -0.01954 |
| J114 | -0.04658 | 0.04429 | 0.10699 | -0.03441 | 0.08957 | 0.01116 |
| J115 | 0.08594 | -0.01741 | -0.01366 | -0.08415 | -0.01917 | 0.04524 |
| J116 | 0.04879 | -0.00032 | -0.01978 | -0.11514 | -0.00405 | -0.08924 |
| J117 | -0.04519 | 0.09673 | -0.03875 | -0.12613 | 0.08848 | 0.03994 |
| J118 | 0.03942 | -0.13202 | 0.01867 | 0.08638 | 0.05083 | -0.01314 |
| J119 | -0.07478 | 0.07982 | -0.08409 | 0.10063 | -0.08984 | -0.09396 |
| J120 | -0.00390 | -0.09616 | -0.04332 | -0.00418 | 0.07287 | 0.11241 |
| J121 | -0.06925 | 0.00847 | 0.05974 | -0.01966 | 0.05165 | 0.09216 |
| J122 | -0.09174 | 0.07934 | 0.04863 | -0.01573 | -0.12476 | 0.01965 |
| J123 | 0.09639 | -0.06017 | -0.02170 | -0.03848 | 0.07087 | -0.10473 |
| J124 | 0.05126 | -0.06057 | 0.12736 | -0.01713 | -0.07459 | 0.05804 |
| J125 | 0.04580 | 0.09325 | 0.00841 | 0.03954 | 0.06247 | 0.12120 |
| J126 | 0.01681 | -0.04292 | 0.05232 | -0.05936 | -0.03985 | -0.12571 |
| J127 | 0.07379 | 0.06662 | 0.00998 | 0.11383 | 0.05983 | -0.04711 |
| J128 | 0.04017 | -0.09433 | -0.06346 | -0.01769 | -0.03369 | -0.06096 |
| J129 | -0.03058 | -0.06256 | 0.02127 | -0.10532 | -0.09966 | -0.06773 |
| J130 | 0.08399 | 0.02617 | -0.11058 | 0.10914 | -0.12982 | -0.06070 |
| J131 | -0.04651 | 0.01535 | 0.02312 | -0.07293 | 0.00428 | 0.07853 |
| J132 | 0.11942 | 0.04390 | -0.01046 | -0.01132 | 0.03355 | -0.04073 |
| J133 | -0.04100 | -0.00267 | 0.13904 | 0.16533 | 0.03936 | 0.08781 |
| J134 | 0.01715 | 0.02824 | 0.00784 | -0.02108 | 0.15429 | 0.05025 |
| J135 | 0.09387 | 0.03236 | -0.07191 | 0.04692 | -0.00793 | 0.01305 |
| J136 | 0.04402 | 0.07838 | 0.08740 | 0.01060 | -0.10131 | 0.05218 |
| J137 | 0.03037 | -0.08230 | -0.02050 | 0.11924 | 0.00578 | -0.03104 |
| J139 | -0.04033 | 0.08924 | -0.07873 | 0.00571 | -0.04392 | -0.10324 |
| J140 | 0.06283 | 0.03732 | -0.10699 | 0.09012 | 0.00379 | 0.09505 |
| J141 | -0.00018 | -0.05639 | -0.05082 | -0.08559 | -0.10545 | 0.09828 |
| J142 | 0.01883 | 0.00997 | 0.06385 | 0.07754 | 0.14243 | -0.08691 |
| J143 | -0.07526 | 0.02134 | 0.05948 | 0.01617 | -0.11427 | 0.03446 |
| J144 | -0.05995 | 0.01750 | 0.10847 | -0.07679 | 0.00949 | -0.06924 |
| J145 | 0.04148 | 0.12978 | 0.07766 | 0.03365 | -0.07629 | -0.12602 |
| J146 | -0.10470 | 0.06798 | 0.02930 | -0.10032 | -0.00694 | -0.02018 |
| J147 | 0.08991 | 0.01315 | -0.03166 | 0.05248 | -0.15273 | -0.03457 |
| J148 | -0.09003 | -0.01308 | -0.05925 | 0.01679 | -0.06427 | 0.12805 |
| J149 | 0.02721 | -0.04232 | -0.08614 | -0.10824 | -0.05631 | 0.09493 |
| J150 | -0.01912 | 0.05706 | -0.08504 | 0.03127 | 0.00598 | 0.04182 |
| J151 | 0.09117 | -0.08459 | 0.10140 | -0.06122 | -0.10561 | 0.09237 |
| J152 | -0.02202 | -0.04100 | -0.06313 | -0.00054 | 0.02306 | 0.14314 |
| J153 | -0.04012 | -0.07298 | 0.01189 | 0.10280 | 0.03694 | -0.10717 |
| J154 | 0.04657 | 0.13107 | 0.13752 | 0.04719 | 0.05026 | 0.00714 |
| J155 | -0.07563 | -0.04006 | 0.00230 | -0.06700 | 0.01859 | -0.11677 |
| J156 | -0.07183 | -0.00912 | -0.01794 | 0.06291 | 0.14311 | 0.00796 |

## TABLE 5-10

Factor Loading Matrix for the Fifty-Five Items of Test J1 in the J1/2259 Case.

| ITEM | FACTOR 1 | FACTOR 2 | FACTOR 3 | FACTOR 4 | FACTOR 5 | FACTOR 6 | FACTOR 7 |
|---|---|---|---|---|---|---|---|
| J101 | 0.591 | -0.194 | 0.109 | 0.055 | -0.057 | -0.142 | -0.015 |
| J102 | 0.476 | -0.103 | -0.059 | -0.150 | -0.079 | 0.053 | 0.177 |
| J103 | 0.497 | -0.189 | -0.088 | -0.049 | 0.088 | -0.054 | 0.265 |
| J104 | 0.582 | 0.078 | -0.208 | -0.058 | 0.025 | -0.004 | -0.051 |
| J105 | 0.625 | 0.127 | -0.019 | -0.028 | 0.090 | 0.074 | -0.046 |
| J106 | 0.447 | 0.052 | -0.176 | -0.125 | 0.063 | -0.121 | 0.126 |
| J107 | 0.507 | 0.011 | -0.199 | -0.003 | 0.231 | 0.112 | -0.108 |
| J108 | 0.614 | 0.092 | 0.066 | -0.194 | -0.294 | 0.369↓ | 0.106 |
| J109 | 0.363 | -0.132 | -0.187 | -0.133 | 0.218 | -0.147 | -0.020 |
| J110 | 0.500 | 0.387↓ | -0.150 | -0.061 | 0.187 | -0.283 | 0.048 |
| J111 | 0.692 | -0.097 | 0.009 | -0.184 | -0.126 | -0.023 | -0.064 |
| J112 | 0.403 | -0.223 | -0.038 | -0.047 | -0.209 | -0.080 | -0.054 |
| J113 | 0.456 | -0.054 | -0.046 | -0.039 | -0.024 | 0.084 | 0.157 |
| J114 | 0.430 | 0.067 | 0.146 | 0.103 | -0.084 | -0.051 | -0.034 |
| J115 | 0.579 | -0.143 | 0.050 | 0.110 | -0.146 | 0.031 | -0.075 |
| J116 | 0.292 | -0.045 | -0.032 | -0.023 | 0.044 | 0.208 | 0.181 |
| J117 | 0.366 | 0.224 | -0.066 | -0.052 | 0.001 | -0.077 | 0.014 |
| J118 | 0.507 | -0.400↓ | -0.078 | -0.028 | 0.130 | -0.183 | 0.107 |
| J119 | 0.550 | -0.136 | -0.261 | -0.002 | 0.180 | -0.022 | -0.131 |
| J120 | 0.283 | -0.064 | 0.170 | 0.038 | -0.150 | -0.022 | -0.091 |
| J121 | 0.428 | -0.043 | -0.045 | -0.073 | 0.010 | -0.007 | 0.118 |
| J122 | 0.414 | -0.070 | 0.017 | 0.022 | -0.075 | -0.129 | 0.095 |
| J123 | 0.418 | -0.057 | 0.019 | -0.040 | -0.015 | -0.042 | 0.023 |
| J124 | 0.493 | -0.072 | -0.123 | 0.023 | 0.236 | 0.260 | -0.040 |
| J125 | 0.413 | -0.042 | -0.134 | -0.185 | 0.050 | -0.006 | 0.010 |
| J126 | 0.347 | 0.109 | 0.052 | -0.046 | -0.141 | -0.028 | -0.106 |
| J127 | 0.468 | -0.195 | -0.104 | -0.125 | 0.058 | 0.137 | -0.098 |
| J128 | 0.565 | -0.072 | 0.045 | -0.098 | -0.155 | 0.067 | 0.121 |
| J129 | 0.609 | 0.022 | -0.054 | 0.144 | 0.165 | 0.095 | -0.120 |
| J130 | 0.334 | 0.282 | -0.023 | -0.098 | -0.112 | -0.192 | 0.112 |
| J131 | 0.627 | -0.270 | 0.021 | -0.020 | -0.058 | -0.069 | -0.160 |
| J132 | 0.309 | -0.052 | 0.074 | 0.084 | -0.100 | 0.052 | -0.167 |
| J133 | 0.638 | 0.211 | -0.139 | -0.232 | -0.219 | 0.114 | -0.179 |
| J134 | 0.291 | -0.161 | 0.086 | 0.136 | -0.053 | -0.147 | 0.219 |
| J135 | 0.651 | 0.136 | -0.108 | -0.057 | 0.088 | 0.044 | 0.036 |
| J136 | 0.348 | -0.083 | -0.151 | 0.085 | -0.150 | -0.045 | -0.110 |
| J137 | 0.512 | 0.025 | 0.053 | 0.048 | 0.030 | 0.100 | -0.220 |
| J139 | 0.354 | 0.113 | 0.015 | 0.146 | 0.167 | -0.076 | 0.201 |
| J140 | 0.392 | 0.007 | 0.582↓ | -0.254 | 0.360↓ | -0.025 | -0.119 |
| J141 | 0.496 | 0.624↓ | 0.018 | -0.065 | -0.098 | -0.050 | -0.032 |
| J142 | 0.411 | 0.164 | -0.004 | 0.095 | -0.105 | -0.207 | -0.031 |
| J143 | 0.509 | 0.113 | 0.123 | 0.015 | -0.063 | 0.050 | -0.009 |
| J144 | 0.361 | 0.019 | 0.659↓ | -0.282 | 0.261 | -0.032 | 0.013 |
| J145 | 0.536 | -0.093 | 0.236 | -0.072 | -0.305↓ | -0.095 | 0.036 |
| J146 | 0.664 | 0.136 | -0.139 | 0.003 | 0.097 | 0.070 | -0.124 |
| J147 | 0.318 | -0.097 | 0.099 | 0.336↓ | 0.040 | 0.028 | -0.129 |
| J148 | 0.465 | -0.164 | 0.079 | 0.033 | -0.013 | 0.054 | 0.057 |
| J149 | 0.457 | 0.019 | -0.056 | -0.059 | 0.030 | -0.076 | 0.189 |
| J150 | 0.459 | 0.012 | 0.067 | -0.006 | -0.013 | 0.031 | 0.058 |
| J151 | 0.422 | -0.104 | 0.105 | 0.221 | -0.087 | 0.002 | 0.121 |
| J152 | 0.369 | -0.088 | 0.031 | 0.238 | -0.146 | -0.079 | 0.038 |
| J153 | 0.361 | 0.401↓ | 0.097 | 0.358↓ | 0.017 | -0.120 | 0.071 |
| J154 | 0.237 | 0.183 | 0.097 | 0.260 | 0.076 | 0.418↓ | 0.330↓ |
| J155 | 0.597 | 0.052 | 0.082 | 0.391↓ | 0.033 | 0.025 | -0.198 |
| J156 | 0.551 | -0.134 | 0.010 | 0.337↓ | 0.166 | -0.041 | 0.039 |

## TABLE 5-10 (Continued)

| ITEM | FACTOR 8 | FACTOR 9 | FACTOR 10 | FACTOR 11 | FACTOR 12 | FACTOR 13 | FACTOR 14 |
|---|---|---|---|---|---|---|---|
| J101 | -0.081 | -0.060 | -0.145 | -0.161 | 0.189 | -0.118 | 0.088 |
| J102 | -0.087 | -0.100 | -0.095 | 0.014 | -0.057 | -0.061 | 0.108 |
| J103 | -0.011 | -0.149 | 0.062 | -0.085 | 0.237 | -0.059 | -0.014 |
| J104 | -0.094 | 0.107 | 0.157 | 0.068 | 0.057 | -0.032 | 0.009 |
| J105 | -0.043 | 0.006 | -0.107 | 0.053 | 0.058 | 0.021 | 0.074 |
| J106 | 0.088 | -0.163 | 0.039 | 0.344 ↓ | 0.120 | -0.115 | 0.225 |
| J107 | -0.028 | 0.065 | 0.080 | -0.021 | 0.003 | 0.091 | -0.022 |
| J108 | 0.219 | -0.070 | -0.009 | 0.036 | 0.029 | 0.232 | -0.041 |
| J109 | -0.046 | 0.126 | -0.261 | -0.015 | -0.009 | 0.107 | 0.112 |
| J110 | 0.216 | -0.045 | -0.013 | -0.159 | 0.065 | 0.088 | -0.042 |
| J111 | -0.048 | 0.054 | -0.176 | -0.130 | -0.033 | 0.023 | 0.018 |
| J112 | -0.164 | 0.038 | -0.063 | 0.109 | 0.022 | -0.093 | 0.008 |
| J113 | -0.162 | 0.017 | 0.314 ↓ | 0.051 | -0.121 | 0.098 | 0.128 |
| J114 | -0.120 | 0.164 | 0.067 | -0.062 | 0.014 | 0.019 | 0.059 |
| J115 | 0.210 | -0.104 | 0.112 | -0.026 | 0.065 | -0.031 | 0.011 |
| J116 | 0.123 | -0.130 | 0.056 | 0.031 | -0.032 | -0.053 | -0.006 |
| J117 | -0.096 | -0.250 | -0.157 | 0.143 | -0.072 | 0.124 | -0.019 |
| J118 | -0.254 | -0.172 | 0.119 | -0.046 | -0.055 | 0.126 | -0.166 |
| J119 | 0.094 | 0.120 | 0.068 | 0.206 | -0.126 | 0.134 | 0.106 |
| J120 | -0.014 | 0.089 | -0.128 | -0.076 | -0.106 | 0.231 | -0.012 |
| J121 | 0.038 | -0.065 | -0.001 | -0.031 | -0.101 | -0.095 | -0.011 |
| J122 | -0.028 | 0.048 | 0.045 | -0.060 | 0.111 | 0.276 | -0.178 |
| J123 | 0.063 | 0.026 | 0.017 | -0.056 | 0.099 | 0.043 | 0.069 |
| J124 | 0.141 | 0.186 | -0.109 | -0.174 | -0.087 | 0.031 | 0.035 |
| J125 | 0.034 | -0.037 | 0.092 | -0.035 | 0.086 | -0.119 | -0.042 |
| J126 | 0.023 | -0.089 | 0.085 | -0.145 | 0.010 | -0.074 | -0.002 |
| J127 | -0.002 | 0.126 | -0.105 | 0.061 | 0.078 | 0.104 | -0.048 |
| J128 | -0.104 | 0.051 | 0.060 | -0.094 | 0.136 | -0.055 | -0.056 |
| J129 | 0.018 | -0.224 | 0.035 | -0.062 | -0.237 | -0.024 | -0.183 |
| J130 | -0.075 | 0.104 | -0.181 | 0.149 | 0.081 | 0.042 | 0.015 |
| J131 | 0.127 | 0.038 | -0.013 | 0.200 | 0.111 | -0.028 | -0.163 |
| J132 | -0.084 | -0.185 | 0.065 | 0.138 | -0.068 | -0.010 | -0.056 |
| J133 | -0.228 | 0.123 | 0.162 | -0.104 | -0.112 | -0.177 | 0.146 |
| J134 | -0.061 | 0.132 | 0.102 | -0.168 | -0.148 | -0.141 | -0.078 |
| J135 | 0.001 | -0.081 | -0.033 | -0.135 | -0.111 | -0.033 | 0.029 |
| J136 | 0.140 | 0.055 | 0.219 | 0.023 | 0.085 | 0.168 | 0.172 |
| J137 | -0.005 | 0.003 | -0.172 | 0.157 | -0.046 | -0.268 | -0.120 |
| J139 | -0.023 | -0.018 | -0.055 | 0.024 | -0.160 | -0.118 | 0.049 |
| J140 | -0.040 | -0.050 | 0.103 | 0.060 | -0.015 | 0.032 | 0.044 |
| J141 | -0.216 | -0.021 | -0.077 | -0.091 | 0.026 | 0.088 | -0.102 |
| J142 | -0.023 | -0.052 | 0.112 | 0.152 | 0.022 | 0.061 | -0.174 |
| J143 | 0.007 | -0.084 | -0.094 | 0.073 | -0.021 | -0.089 | -0.042 |
| J144 | 0.002 | 0.102 | 0.114 | 0.049 | 0.024 | 0.008 | 0.090 |
| J145 | 0.281 | 0.023 | -0.095 | 0.049 | -0.154 | -0.027 | -0.037 |
| J146 | -0.002 | -0.029 | 0.071 | -0.107 | -0.039 | -0.077 | -0.071 |
| J147 | -0.233 | 0.038 | 0.047 | 0.074 | 0.053 | 0.109 | -0.095 |
| J148 | 0.112 | -0.108 | -0.030 | -0.053 | -0.068 | 0.008 | -0.124 |
| J149 | 0.168 | 0.401 ↓ | 0.045 | 0.053 | -0.002 | -0.161 | -0.236 |
| J150 | 0.031 | 0.002 | -0.062 | 0.011 | -0.009 | 0.044 | 0.041 |
| J151 | -0.000 | -0.082 | -0.093 | -0.113 | -0.124 | 0.105 | 0.302 ↓ |
| J152 | -0.100 | 0.140 | -0.012 | 0.153 | -0.202 | -0.038 | 0.121 |
| J153 | 0.213 | 0.062 | 0.161 | 0.045 | -0.097 | 0.013 | 0.048 |
| J154 | -0.189 | 0.100 | -0.062 | 0.156 | 0.186 | 0.024 | -0.071 |
| J155 | 0.064 | -0.043 | 0.004 | -0.127 | 0.358 ↓ | -0.102 | 0.138 |
| J156 | 0.012 | 0.013 | -0.175 | 0.018 | -0.029 | -0.006 | 0.017 |

TABLE 5-10 (Continued)

| ITEM | FACTOR 15 | FACTOR 16 | FACTOR 17 | FACTOR 18 | FACTOR 19 | FACTOR 20 | FACTOR 21 |
|---|---|---|---|---|---|---|---|
| J101 | -0.036 | -0.095 | -0.035 | 0.043 | -0.132 | -0.099 | 0.036 |
| J102 | -0.005 | 0.178 | 0.144 | -0.146 | -0.089 | -0.093 | -0.078 |
| J103 | 0.036 | 0.125 | 0.044 | 0.108 | 0.209 | 0.014 | 0.009 |
| J104 | -0.063 | 0.058 | 0.049 | -0.014 | -0.062 | 0.085 | -0.028 |
| J105 | 0.001 | -0.020 | -0.006 | -0.141 | -0.133 | -0.105 | -0.047 |
| J106 | -0.088 | 0.070 | -0.016 | 0.037 | -0.126 | -0.004 | -0.051 |
| J107 | 0.049 | 0.028 | -0.023 | -0.018 | -0.037 | -0.060 | 0.053 |
| J108 | 0.078 | -0.012 | -0.143 | 0.049 | -0.121 | -0.102 | -0.105 |
| J109 | -0.023 | 0.052 | -0.101 | -0.030 | -0.147 | 0.172 | -0.074 |
| J110 | -0.143 | 0.081 | -0.004 | -0.122 | 0.192 | -0.116 | 0.021 |
| J111 | -0.180 | 0.047 | -0.099 | -0.160 | 0.052 | -0.063 | -0.014 |
| J112 | 0.011 | 0.150 | -0.208 | 0.041 | 0.100 | -0.195 | 0.184 |
| J113 | -0.164 | -0.151 | 0.129 | 0.100 | -0.042 | -0.018 | 0.159 |
| J114 | -0.134 | 0.160 | -0.025 | 0.150 | -0.096 | 0.073 | -0.099 |
| J115 | 0.016 | 0.135 | 0.168 | -0.149 | 0.066 | 0.086 | 0.007 |
| J116 | 0.180 | 0.043 | -0.060 | 0.066 | -0.050 | 0.070 | 0.056 |
| J117 | 0.165 | 0.033 | -0.058 | -0.025 | 0.100 | 0.055 | -0.070 |
| J118 | 0.054 | -0.009 | -0.026 | -0.116 | 0.032 | 0.032 | -0.054 |
| J119 | -0.078 | -0.013 | -0.017 | -0.004 | 0.035 | 0.134 | 0.044 |
| J120 | -0.022 | 0.113 | 0.263 | 0.059 | 0.060 | 0.169 | -0.173 |
| J121 | 0.031 | -0.087 | 0.104 | 0.008 | -0.154 | 0.012 | 0.099 |
| J122 | -0.080 | 0.089 | -0.010 | 0.246 | -0.067 | -0.182 | -0.083 |
| J123 | -0.130 | -0.112 | 0.056 | 0.124 | 0.038 | 0.030 | -0.039 |
| J124 | 0.124 | 0.241 | 0.095 | 0.066 | -0.046 | -0.026 | 0.249 |
| J125 | 0.010 | 0.089 | -0.122 | 0.213 | -0.016 | 0.185 | -0.007 |
| J126 | -0.132 | 0.002 | -0.032 | -0.113 | -0.204 | 0.163 | 0.002 |
| J127 | 0.087 | -0.204 | 0.017 | 0.040 | 0.145 | 0.003 | 0.066 |
| J128 | 0.061 | 0.043 | 0.139 | -0.107 | 0.024 | 0.052 | 0.072 |
| J129 | 0.019 | -0.080 | 0.006 | 0.066 | 0.010 | -0.096 | -0.122 |
| J130 | 0.262 | -0.110 | 0.081 | 0.096 | -0.061 | -0.030 | 0.020 |
| J131 | -0.029 | -0.105 | 0.120 | 0.083 | 0.081 | 0.035 | 0.007 |
| J132 | -0.070 | 0.126 | 0.017 | 0.068 | 0.005 | -0.004 | -0.019 |
| J133 | 0.140 | -0.102 | -0.001 | 0.034 | 0.116 | -0.041 | -0.138 |
| J134 | 0.160 | -0.052 | -0.014 | -0.045 | -0.073 | 0.015 | -0.049 |
| J135 | 0.096 | -0.072 | -0.048 | 0.080 | 0.057 | 0.078 | -0.157 |
| J136 | 0.121 | -0.071 | 0.046 | -0.206 | 0.068 | -0.095 | -0.031 |
| J137 | -0.188 | -0.012 | 0.130 | 0.058 | 0.033 | -0.066 | -0.027 |
| J139 | -0.012 | 0.048 | 0.176 | 0.025 | 0.099 | -0.047 | -0.011 |
| J140 | 0.019 | -0.002 | -0.057 | -0.032 | -0.009 | -0.031 | -0.061 |
| J141 | -0.024 | -0.022 | 0.015 | 0.022 | 0.040 | 0.139 | 0.240 |
| J142 | 0.019 | -0.129 | 0.036 | -0.086 | -0.092 | 0.035 | 0.113 |
| J143 | 0.028 | 0.036 | 0.066 | -0.000 | -0.020 | 0.038 | 0.071 |
| J144 | 0.079 | -0.002 | -0.010 | -0.014 | 0.065 | -0.016 | 0.061 |
| J145 | 0.017 | 0.033 | -0.025 | 0.013 | 0.041 | 0.005 | 0.064 |
| J146 | -0.084 | -0.012 | -0.092 | -0.017 | -0.003 | -0.164 | 0.005 |
| J147 | 0.088 | 0.152 | -0.038 | -0.054 | -0.142 | -0.045 | 0.044 |
| J148 | -0.091 | -0.109 | -0.236 | -0.080 | 0.009 | 0.200 | 0.111 |
| J149 | -0.056 | -0.067 | -0.070 | -0.068 | -0.034 | -0.022 | -0.123 |
| J150 | 0.012 | -0.027 | 0.060 | -0.127 | -0.053 | -0.001 | 0.005 |
| J151 | -0.199 | -0.186 | -0.045 | 0.089 | 0.056 | -0.039 | 0.070 |
| J152 | 0.085 | 0.114 | -0.209 | -0.025 | 0.171 | 0.073 | -0.009 |
| J153 | 0.022 | 0.106 | -0.073 | 0.058 | -0.038 | -0.039 | -0.003 |
| J154 | -0.183 | -0.029 | -0.045 | -0.123 | 0.124 | 0.065 | -0.083 |
| J155 | 0.150 | -0.051 | -0.066 | 0.028 | 0.036 | 0.085 | -0.059 |
| J156 | 0.098 | -0.168 | 0.059 | 0.015 | -0.088 | -0.050 | -0.006 |

## TABLE 5-10 (Continued)

| ITEM | FACTOR 22 | FACTOR 23 | FACTOR 24 | FACTOR 25 | FACTOR 26 | FACTOR 27 | FACTOR 28 |
|---|---|---|---|---|---|---|---|
| J101 | 0.189 | 0.165 | -0.023 | -0.220 | 0.084 | 0.012 | 0.065 |
| J102 | 0.007 | 0.041 | -0.086 | -0.075 | -0.098 | -0.022 | -0.103 |
| J103 | -0.151 | 0.022 | 0.093 | 0.041 | 0.167 | -0.032 | 0.125 |
| J104 | -0.145 | 0.032 | 0.060 | -0.102 | 0.070 | 0.087 | -0.071 |
| J105 | 0.030 | -0.080 | -0.038 | -0.090 | -0.047 | 0.018 | -0.009 |
| J106 | -0.040 | 0.011 | 0.042 | 0.028 | -0.046 | -0.007 | 0.051 |
| J107 | -0.083 | -0.005 | -0.032 | -0.045 | 0.026 | -0.028 | 0.092 |
| J108 | -0.060 | -0.042 | 0.021 | -0.003 | 0.130 | -0.096 | -0.025 |
| J109 | 0.071 | 0.006 | -0.019 | 0.031 | 0.181 | -0.013 | 0.040 |
| J110 | -0.027 | -0.071 | -0.119 | -0.047 | -0.088 | -0.108 | -0.043 |
| J111 | -0.002 | 0.077 | 0.012 | 0.132 | -0.062 | 0.014 | 0.063 |
| J112 | 0.090 | -0.097 | 0.024 | 0.039 | 0.024 | -0.082 | -0.108 |
| J113 | 0.095 | -0.137 | -0.140 | -0.106 | -0.058 | 0.010 | 0.155 |
| J114 | -0.096 | -0.161 | -0.054 | -0.061 | 0.090 | -0.085 | -0.078 |
| J115 | 0.276 | -0.113 | 0.061 | 0.098 | 0.063 | 0.004 | 0.103 |
| J116 | -0.011 | 0.130 | -0.095 | -0.034 | -0.025 | 0.009 | -0.119 |
| J117 | 0.098 | -0.032 | -0.007 | 0.019 | -0.008 | 0.194 | 0.102 |
| J118 | -0.058 | -0.080 | -0.027 | -0.050 | -0.064 | 0.053 | -0.072 |
| J119 | 0.124 | 0.092 | 0.129 | 0.077 | -0.060 | 0.062 | -0.160 |
| J120 | -0.008 | -0.004 | 0.074 | -0.075 | -0.075 | -0.117 | 0.014 |
| J121 | 0.023 | 0.025 | -0.004 | 0.123 | 0.068 | -0.084 | -0.045 |
| J122 | 0.137 | 0.096 | -0.043 | 0.153 | -0.077 | 0.083 | 0.034 |
| J123 | 0.006 | 0.100 | -0.004 | -0.067 | 0.065 | 0.032 | -0.036 |
| J124 | 0.006 | 0.037 | -0.018 | 0.012 | -0.040 | 0.043 | -0.004 |
| J125 | 0.080 | -0.117 | 0.100 | -0.023 | -0.076 | 0.002 | 0.009 |
| J126 | -0.169 | 0.071 | -0.031 | 0.069 | -0.096 | -0.029 | 0.136 |
| J127 | -0.144 | -0.005 | -0.068 | -0.004 | -0.045 | 0.021 | 0.151 |
| J128 | -0.088 | 0.086 | -0.009 | 0.049 | -0.044 | 0.143 | 0.022 |
| J129 | 0.006 | 0.101 | 0.021 | -0.088 | 0.067 | 0.046 | -0.044 |
| J130 | -0.067 | 0.018 | 0.032 | 0.040 | -0.131 | -0.133 | -0.006 |
| J131 | 0.035 | 0.085 | -0.116 | -0.099 | -0.082 | -0.112 | -0.109 |
| J132 | -0.111 | 0.135 | -0.128 | 0.208 | 0.016 | -0.023 | -0.020 |
| J133 | 0.125 | -0.064 | -0.105 | 0.097 | 0.014 | 0.012 | -0.011 |
| J134 | 0.046 | 0.114 | 0.144 | 0.023 | -0.024 | -0.052 | -0.041 |
| J135 | 0.040 | -0.044 | 0.071 | -0.011 | -0.056 | -0.078 | 0.022 |
| J136 | -0.030 | 0.074 | 0.063 | 0.008 | 0.174 | -0.101 | -0.019 |
| J137 | -0.012 | 0.038 | 0.050 | 0.016 | 0.070 | -0.013 | 0.075 |
| J139 | -0.044 | -0.084 | -0.107 | 0.047 | 0.130 | -0.080 | -0.089 |
| J140 | -0.020 | 0.005 | -0.059 | 0.029 | 0.090 | 0.065 | -0.030 |
| J141 | 0.036 | 0.090 | 0.002 | -0.007 | 0.164 | 0.038 | -0.088 |
| J142 | -0.004 | -0.030 | 0.106 | 0.006 | 0.044 | -0.010 | -0.030 |
| J143 | -0.016 | -0.087 | 0.084 | 0.022 | -0.086 | -0.029 | 0.050 |
| J144 | 0.031 | 0.043 | 0.114 | 0.029 | -0.059 | -0.078 | 0.019 |
| J145 | -0.083 | -0.165 | 0.041 | -0.175 | 0.048 | 0.228 | -0.029 |
| J146 | -0.067 | -0.006 | 0.253 | -0.081 | -0.107 | -0.054 | 0.020 |
| J147 | -0.039 | -0.119 | 0.037 | 0.006 | -0.005 | -0.021 | 0.009 |
| J148 | 0.055 | -0.049 | -0.145 | 0.026 | -0.013 | -0.192 | 0.002 |
| J149 | -0.030 | -0.055 | -0.077 | 0.111 | 0.034 | 0.126 | -0.007 |
| J150 | 0.008 | 0.045 | -0.066 | -0.022 | -0.045 | 0.066 | -0.038 |
| J151 | -0.131 | -0.023 | 0.115 | 0.135 | -0.053 | 0.094 | -0.108 |
| J152 | -0.088 | 0.165 | -0.064 | -0.122 | -0.007 | -0.044 | 0.139 |
| J153 | 0.071 | 0.114 | -0.059 | -0.019 | -0.044 | 0.028 | 0.124 |
| J154 | 0.117 | 0.030 | 0.076 | -0.032 | -0.021 | -0.019 | -0.030 |
| J155 | -0.038 | -0.065 | -0.104 | 0.039 | -0.104 | 0.091 | -0.134 |
| J156 | -0.021 | -0.136 | -0.006 | 0.104 | 0.060 | -0.013 | 0.104 |

## TABLE 5-10 (Continued)

| ITEM | FACTOR 29 | FACTOR 30 | FACTOR 31 | FACTOR 32 | FACTOR 33 | FACTOR 34 | FACTOR 35 |
|---|---|---|---|---|---|---|---|
| J101 | -0.057 | -0.154 | -0.000 | 0.000 | -0.081 | -0.077 | -0.054 |
| J102 | -0.100 | -0.034 | -0.099 | -0.065 | -0.142 | 0.018 | 0.046 |
| J103 | -0.057 | -0.002 | 0.097 | -0.062 | -0.010 | -0.050 | -0.060 |
| J104 | -0.034 | 0.103 | -0.075 | -0.030 | -0.082 | 0.119 | 0.050 |
| J105 | 0.063 | 0.044 | 0.061 | 0.021 | 0.081 | 0.045 | -0.035 |
| J106 | 0.150 | -0.087 | -0.004 | -0.048 | 0.010 | 0.010 | 0.030 |
| J107 | -0.026 | -0.016 | -0.049 | 0.053 | -0.088 | -0.027 | -0.011 |
| J108 | -0.045 | -0.025 | -0.094 | -0.072 | 0.040 | 0.027 | -0.037 |
| J109 | -0.038 | 0.154 | -0.087 | 0.074 | 0.027 | -0.059 | -0.031 |
| J110 | -0.028 | 0.035 | -0.032 | -0.079 | 0.072 | -0.058 | 0.055 |
| J111 | 0.243 | 0.011 | 0.139 | -0.068 | -0.101 | 0.054 | -0.047 |
| J112 | -0.018 | -0.020 | -0.013 | -0.014 | 0.153 | -0.015 | -0.053 |
| J113 | -0.003 | -0.031 | 0.022 | -0.041 | 0.063 | -0.030 | -0.020 |
| J114 | -0.043 | 0.020 | 0.221 | 0.032 | -0.031 | 0.004 | -0.061 |
| J115 | -0.041 | 0.141 | -0.026 | 0.034 | -0.047 | -0.011 | -0.098 |
| J116 | 0.051 | 0.114 | 0.103 | -0.048 | -0.040 | -0.115 | -0.053 |
| J117 | -0.205 | -0.091 | 0.080 | -0.030 | 0.030 | 0.155 | -0.043 |
| J118 | 0.124 | -0.039 | 0.006 | 0.114 | -0.027 | 0.019 | -0.017 |
| J119 | -0.068 | -0.127 | 0.061 | -0.048 | 0.046 | -0.091 | -0.026 |
| J120 | 0.014 | -0.135 | 0.032 | -0.015 | 0.011 | -0.066 | -0.005 |
| J121 | 0.010 | -0.065 | 0.135 | 0.058 | 0.057 | -0.003 | 0.046 |
| J122 | -0.000 | 0.080 | -0.038 | -0.015 | 0.012 | -0.012 | 0.125 |
| J123 | -0.064 | -0.005 | -0.002 | 0.006 | 0.047 | 0.059 | 0.141 |
| J124 | 0.010 | -0.020 | 0.060 | -0.048 | 0.013 | 0.070 | 0.037 |
| J125 | 0.099 | -0.006 | -0.121 | 0.083 | -0.011 | 0.069 | 0.046 |
| J126 | -0.032 | -0.004 | -0.064 | -0.072 | 0.179 | -0.014 | -0.103 |
| J127 | -0.007 | -0.082 | -0.021 | -0.041 | -0.013 | 0.034 | -0.061 |
| J128 | -0.016 | 0.080 | 0.019 | 0.098 | 0.062 | 0.008 | 0.043 |
| J129 | 0.102 | 0.053 | 0.009 | -0.039 | -0.020 | -0.055 | -0.052 |
| J130 | -0.016 | 0.065 | 0.099 | 0.127 | -0.052 | 0.012 | -0.036 |
| J131 | 0.015 | 0.143 | -0.044 | -0.009 | 0.060 | 0.101 | -0.133 |
| J132 | -0.027 | -0.119 | -0.077 | 0.155 | -0.006 | -0.086 | -0.005 |
| J133 | -0.007 | 0.057 | -0.003 | -0.010 | -0.054 | -0.043 | 0.035 |
| J134 | -0.029 | -0.040 | -0.027 | -0.093 | 0.137 | 0.132 | 0.012 |
| J135 | 0.073 | -0.022 | -0.024 | -0.074 | 0.045 | -0.018 | 0.014 |
| J136 | 0.089 | -0.083 | 0.031 | 0.079 | 0.014 | 0.061 | 0.092 |
| J137 | -0.011 | 0.013 | 0.029 | -0.036 | -0.002 | 0.100 | 0.090 |
| J139 | -0.016 | -0.056 | -0.111 | 0.020 | 0.019 | 0.063 | -0.062 |
| J140 | -0.040 | 0.058 | 0.127 | -0.020 | 0.100 | 0.020 | 0.057 |
| J141 | 0.117 | -0.068 | -0.099 | 0.003 | 0.009 | -0.004 | -0.027 |
| J142 | -0.054 | 0.092 | 0.059 | -0.168 | -0.111 | -0.087 | 0.032 |
| J143 | -0.026 | 0.008 | 0.015 | -0.035 | -0.028 | -0.105 | 0.134 |
| J144 | 0.021 | -0.031 | -0.149 | -0.005 | -0.105 | -0.020 | -0.042 |
| J145 | 0.100 | -0.038 | -0.012 | 0.083 | 0.028 | -0.049 | 0.043 |
| J146 | -0.168 | 0.011 | 0.025 | 0.195 | 0.015 | -0.050 | -0.027 |
| J147 | 0.006 | -0.040 | -0.065 | -0.117 | -0.034 | 0.047 | -0.004 |
| J148 | -0.096 | -0.044 | 0.048 | 0.058 | -0.127 | 0.106 | 0.127 |
| J149 | -0.071 | -0.137 | -0.017 | -0.030 | -0.073 | -0.073 | -0.071 |
| J150 | -0.082 | 0.039 | -0.049 | 0.103 | 0.078 | -0.059 | 0.024 |
| J151 | -0.066 | 0.110 | -0.054 | -0.017 | -0.092 | 0.059 | -0.077 |
| J152 | -0.024 | 0.106 | -0.033 | -0.049 | 0.029 | -0.080 | 0.087 |
| J153 | 0.063 | -0.011 | 0.033 | 0.108 | -0.059 | 0.110 | -0.080 |
| J154 | 0.059 | 0.005 | 0.024 | 0.057 | 0.058 | -0.025 | 0.006 |
| J155 | -0.002 | -0.081 | 0.000 | -0.047 | 0.009 | -0.025 | 0.027 |
| J156 | 0.092 | 0.050 | -0.075 | 0.024 | 0.049 | -0.067 | 0.069 |

### TABLE 5-10 (Continued)

| ITEM | FACTOR 36 | FACTOR 37 | FACTOR 38 | FACTOR 39 | FACTOR 40 | FACTOR 41 | FACTOR 42 |
|---|---|---|---|---|---|---|---|
| J101 | 0.023 | 0.022 | -0.020 | -0.062 | -0.024 | 0.040 | 0.045 |
| J102 | 0.003 | -0.133 | -0.020 | 0.034 | -0.069 | -0.004 | -0.023 |
| J103 | -0.071 | 0.018 | 0.018 | 0.022 | -0.055 | -0.085 | -0.024 |
| J104 | 0.038 | 0.140 | -0.066 | 0.016 | -0.088 | 0.052 | 0.055 |
| J105 | 0.030 | 0.131 | -0.011 | -0.027 | -0.081 | -0.075 | -0.019 |
| J106 | -0.145 | 0.013 | -0.026 | -0.001 | 0.085 | 0.050 | -0.005 |
| J107 | -0.054 | -0.031 | 0.116 | -0.044 | -0.093 | -0.033 | 0.042 |
| J108 | 0.032 | -0.020 | -0.040 | -0.045 | 0.017 | 0.004 | -0.025 |
| J109 | -0.040 | 0.040 | -0.010 | 0.006 | 0.107 | -0.055 | -0.013 |
| J110 | 0.022 | 0.020 | -0.027 | -0.091 | 0.027 | 0.037 | -0.012 |
| J111 | 0.079 | -0.035 | 0.013 | -0.028 | 0.046 | -0.035 | -0.001 |
| J112 | -0.033 | 0.097 | 0.004 | 0.110 | -0.067 | 0.053 | -0.011 |
| J113 | 0.038 | -0.013 | -0.052 | -0.021 | 0.057 | -0.067 | -0.044 |
| J114 | 0.041 | -0.097 | 0.002 | -0.034 | -0.008 | 0.095 | -0.060 |
| J115 | -0.012 | -0.057 | -0.057 | -0.012 | -0.003 | 0.058 | 0.030 |
| J116 | 0.013 | 0.021 | 0.177 | -0.029 | 0.053 | 0.033 | -0.005 |
| J117 | 0.085 | 0.010 | 0.034 | 0.019 | 0.018 | -0.021 | -0.044 |
| J118 | -0.053 | -0.050 | 0.017 | 0.075 | 0.005 | 0.011 | -0.008 |
| J119 | 0.016 | -0.010 | 0.041 | -0.112 | -0.068 | 0.030 | -0.088 |
| J120 | -0.051 | 0.122 | 0.026 | 0.035 | -0.018 | -0.028 | 0.015 |
| J121 | 0.182 | 0.045 | -0.001 | 0.075 | 0.006 | -0.025 | 0.108 |
| J122 | 0.001 | 0.013 | 0.060 | -0.022 | -0.034 | -0.019 | 0.059 |
| J123 | -0.019 | -0.002 | 0.035 | 0.127 | 0.087 | 0.025 | -0.066 |
| J124 | -0.080 | -0.026 | -0.121 | 0.073 | 0.028 | -0.041 | -0.007 |
| J125 | 0.136 | -0.068 | -0.001 | -0.057 | -0.052 | -0.056 | 0.000 |
| J126 | -0.029 | -0.000 | 0.069 | 0.044 | -0.071 | -0.030 | 0.007 |
| J127 | -0.021 | -0.030 | -0.010 | -0.035 | 0.004 | 0.113 | 0.070 |
| J128 | 0.071 | 0.118 | -0.021 | -0.097 | 0.055 | 0.107 | -0.057 |
| J129 | 0.008 | 0.080 | -0.098 | 0.004 | -0.014 | -0.008 | -0.091 |
| J130 | -0.041 | -0.022 | -0.071 | -0.049 | -0.015 | -0.030 | -0.008 |
| J131 | 0.016 | -0.056 | 0.017 | 0.048 | 0.012 | -0.045 | -0.008 |
| J132 | -0.014 | 0.001 | -0.136 | -0.050 | 0.025 | -0.015 | 0.005 |
| J133 | -0.135 | 0.046 | 0.056 | -0.008 | 0.011 | -0.031 | 0.006 |
| J134 | -0.110 | -0.051 | -0.021 | -0.129 | 0.008 | -0.015 | -0.023 |
| J135 | 0.031 | -0.022 | -0.050 | 0.099 | 0.029 | 0.112 | 0.095 |
| J136 | 0.059 | -0.040 | 0.047 | 0.030 | -0.008 | -0.034 | -0.026 |
| J137 | -0.018 | -0.038 | 0.089 | -0.042 | 0.023 | -0.011 | -0.017 |
| J139 | 0.056 | 0.047 | 0.075 | -0.073 | 0.042 | -0.026 | 0.078 |
| J140 | -0.049 | -0.087 | -0.045 | -0.015 | -0.054 | 0.007 | 0.073 |
| J141 | -0.030 | -0.105 | 0.018 | 0.019 | -0.015 | 0.012 | -0.032 |
| J142 | -0.032 | 0.001 | -0.064 | 0.024 | 0.027 | -0.042 | 0.057 |
| J143 | 0.037 | -0.000 | 0.064 | 0.049 | -0.050 | 0.007 | -0.052 |
| J144 | 0.065 | 0.079 | 0.020 | 0.030 | 0.030 | -0.007 | -0.063 |
| J145 | -0.081 | 0.006 | 0.018 | -0.060 | 0.015 | -0.048 | 0.059 |
| J146 | 0.002 | -0.047 | 0.015 | 0.010 | 0.105 | -0.018 | 0.014 |
| J147 | 0.016 | 0.023 | 0.080 | -0.017 | 0.143 | 0.017 | 0.023 |
| J148 | -0.099 | 0.097 | -0.004 | -0.030 | -0.018 | 0.006 | -0.019 |
| J149 | 0.041 | -0.010 | -0.022 | 0.095 | 0.006 | -0.018 | -0.037 |
| J150 | -0.042 | -0.062 | 0.064 | 0.074 | 0.014 | 0.025 | 0.016 |
| J151 | -0.011 | 0.002 | 0.004 | 0.017 | -0.023 | -0.010 | 0.015 |
| J152 | 0.119 | -0.053 | -0.049 | 0.004 | 0.002 | -0.032 | 0.023 |
| J153 | -0.052 | 0.040 | 0.037 | 0.075 | -0.037 | 0.044 | 0.005 |
| J154 | -0.044 | -0.009 | -0.029 | 0.002 | -0.018 | -0.028 | 0.048 |
| J155 | 0.026 | -0.003 | -0.037 | 0.003 | 0.036 | -0.080 | 0.006 |
| J156 | 0.017 | -0.041 | 0.005 | -0.008 | -0.094 | 0.065 | -0.090 |

presented in Tables 5-11 and 5-12, together with the proportion correct $\hat{p}_g$ and the normal deviate $\hat{\gamma}_g$, for each item. Comparison of these two tables reveals that these two sets of results are fairly consistent with each other. It is also observed that the estimation of both the discrimination and difficulty parameters has been substantially ameliorated by the addition of older examinees, i.e., 460 and 461 second graders of junior high schools, respectively, in the J1/1075 and J1/2259 Cases, the fact which is especially conspicuous in the estimated discrimination and difficulty parameters of items J154, J120 and J134 in these tables when they are compared with the corresponding values shown in Table 5-3.

## VI. Scale Adjustment I

As was mentioned in the preceding section, the estimated item parameters obtained as the result of the Tetrachoric Method are based upon the ability scale whose origin and unit are set equal to the mean and the standard deviation of the ability distribution of each specific examinee group. The results shown in Tables 5-1 through 5-4, 5-11 and 5-12 in the preceding section, therefore, are not directly comparable with one another. In order to make them comparable, we need some appropriate scale adjustment, or equating, so that all the estimated item characteristic functions be put on the single ability scale.

As we can see in Table 3-1, there are a certain number of test items which belong to the two tests of each pair of adjacent tests.

## TABLE 5-11

**Estimates of the Item Discrimination And Difficulty Parameters of Each of the 55 Items of Test J1, Together with Its Proportion Correct And Normal Deviate. J1/1075 Case.**

| Item $g$ | Discrimination Parameter $\hat{a}_g$ | Difficulty Parameter $\hat{b}_g$ | Proportion Correct $\hat{p}_g$ | Normal Deviate $\hat{\gamma}_g$ |
|---|---|---|---|---|
| J101 | 0.771 | -0.304 | 0.57356 | -0.18545 |
| J102 | 0.541 | -1.036 | 0.68901 | -0.49305 |
| J103 | 0.642 | -1.240 | 0.74860 | -0.67009 |
| J104 | 0.708 | -1.125 | 0.74209 | -0.64980 |
| J105 | 0.783 | -0.461 | 0.61173 | -0.28383 |
| J106 | 0.500 | -0.934 | 0.66201 | -0.41796 |
| J107 | 0.567 | -0.299 | 0.55866 | -0.14757 |
| J108 | 0.826 | -2.102 | 0.90968 | -1.33879 |
| J109 | 0.330 | -1.317 | 0.66015 | -0.41287 |
| J110 | 0.640 | -0.724 | 0.65177 | -0.39010 |
| J111 | 0.983 | -1.473 | 0.84916 | -1.03284 |
| J112 | 0.485 | -0.916 | 0.65549 | -0.40019 |
| J113 | 0.554 | -1.213 | 0.72160 | -0.58760 |
| J114 | 0.632 | -0.096 | 0.52048 | -0.05136 |
| J115 | 0.815 | -0.457 | 0.61359 | -0.28869 |
| J116 | 0.385 | -1.221 | 0.66946 | -0.43842 |
| J117 | 0.354 | -0.785 | 0.60335 | -0.26203 |
| J118 | 0.559 | -1.273 | 0.73277 | -0.62121 |
| J119 | 0.614 | -1.182 | 0.73184 | -0.61839 |
| J120 | 0.302 | 0.983 | 0.38827 | 0.28383 |
| J121 | 0.499 | -0.988 | 0.67039 | -0.44099 |
| J122 | 0.534 | -1.030 | 0.68622 | -0.48516 |
| J123 | 0.528 | -0.045 | 0.50838 | -0.02101 |
| J124 | 0.576 | -1.859 | 0.82309 | -0.92721 |
| J125 | 0.522 | -1.776 | 0.79423 | -0.82119 |
| J126 | 0.475 | -0.805 | 0.63501 | -0.34515 |
| J127 | 0.543 | -1.757 | 0.79888 | -0.83763 |
| J128 | 0.776 | -1.141 | 0.75791 | -0.69960 |
| J129 | 0.793 | 1.131 | 0.24115 | 0.70261 |
| J130 | 0.351 | -1.988 | 0.74488 | -0.65846 |
| J131 | 0.876 | -0.554 | 0.64246 | -0.36504 |
| J132 | 0.432 | -0.248 | 0.53911 | -0.09819 |
| J133 | 0.732 | -1.818 | 0.85847 | -1.07347 |
| J134 | 0.306 | 1.848 | 0.29423 | 0.54107 |
| J135 | 0.836 | -0.356 | 0.59032 | -0.22837 |
| J136 | 0.368 | 0.027 | 0.49628 | 0.00932 |
| J137 | 0.682 | -0.153 | 0.53445 | -0.08646 |
| J139 | 0.418 | 1.071 | 0.33985 | 0.41287 |
| J140 | 0.420 | -0.012 | 0.50186 | -0.00466 |
| J141 | 0.577 | -1.115 | 0.71136 | -0.55736 |
| J142 | 0.499 | 0.120 | 0.47858 | 0.05372 |
| J143 | 0.702 | -0.435 | 0.59870 | -0.24998 |
| J144 | 0.389 | -0.723 | 0.60335 | -0.26203 |
| J145 | 0.776 | -0.499 | 0.62011 | -0.30577 |
| J146 | 0.865 | -0.309 | 0.58007 | -0.20207 |
| J147 | 0.447 | -0.000 | 0.50000 | 0.00000 |
| J148 | 0.510 | 0.144 | 0.47393 | 0.06539 |
| J149 | 0.514 | -0.453 | 0.58194 | -0.20686 |
| J150 | 0.515 | -0.332 | 0.56052 | -0.15229 |
| J151 | 0.486 | 0.666 | 0.38547 | 0.29115 |
| J152 | 0.345 | 0.366 | 0.45251 | 0.11932 |
| J153 | 0.463 | 1.187 | 0.30912 | 0.49835 |
| J154 | 0.224 | 1.890 | 0.33985 | 0.41287 |
| J155 | 0.860 | 0.744 | 0.31378 | 0.48516 |
| J156 | 0.711 | 1.131 | 0.25605 | 0.65557 |

## TABLE 5-12

**Estimates of the Item Discrimination And Difficulty Parameters of Each of the 55 Items of Test J1, Together with Its Proportion Correct And Normal Deviate. J1/2259 Case.**

| Item $g$ | Discrimination Parameter $\hat{a}_g$ | Difficulty Parameter $\hat{b}_g$ | Proportion Correct $\hat{p}_g$ | Normal Deviate $\hat{\gamma}_g$ |
|---|---|---|---|---|
| J101 | 0.733 | -0.528 | 0.62240 | -0.31179 |
| J102 | 0.541 | -1.240 | 0.72244 | -0.59011 |
| J103 | 0.573 | -1.545 | 0.77866 | -0.76768 |
| J104 | 0.716 | -1.094 | 0.73794 | -0.63701 |
| J105 | 0.801 | -0.388 | 0.59584 | -0.24259 |
| J106 | 0.500 | -1.027 | 0.67685 | -0.45891 |
| J107 | 0.588 | -0.089 | 0.51793 | -0.04496 |
| J108 | 0.778 | -2.249 | 0.91633 | -1.38080 |
| J109 | 0.390 | -1.156 | 0.66268 | -0.41979 |
| J110 | 0.577 | -0.617 | 0.62107 | -0.30829 |
| J111 | 0.959 | -1.548 | 0.85790 | -1.07093 |
| J112 | 0.440 | -1.319 | 0.70252 | -0.53166 |
| J113 | 0.512 | -1.344 | 0.72997 | -0.61272 |
| J114 | 0.476 | 0.190 | 0.46746 | 0.08166 |
| J115 | 0.710 | -0.514 | 0.61709 | -0.29785 |
| J116 | 0.305 | -1.949 | 0.71536 | -0.56911 |
| J117 | 0.393 | -0.913 | 0.63081 | -0.33400 |
| J118 | 0.588 | -1.851 | 0.82603 | -0.93859 |
| J119 | 0.659 | -1.256 | 0.75520 | -0.69095 |
| J120 | 0.295 | 0.757 | 0.41523 | 0.21411 |
| J121 | 0.474 | -1.189 | 0.69456 | -0.50882 |
| J122 | 0.455 | -1.321 | 0.70784 | -0.54709 |
| J123 | 0.460 | -0.142 | 0.52368 | -0.05939 |
| J124 | 0.567 | -1.594 | 0.78398 | -0.78571 |
| J125 | 0.453 | -1.969 | 0.79194 | -0.81317 |
| J126 | 0.370 | -0.712 | 0.59761 | -0.24717 |
| J127 | 0.530 | -1.581 | 0.77025 | -0.73967 |
| J128 | 0.685 | -1.377 | 0.78176 | -0.77815 |
| J129 | 0.768 | 1.112 | 0.24923 | 0.67691 |
| J130 | 0.354 | -2.115 | 0.76007 | -0.70653 |
| J131 | 0.805 | -0.781 | 0.68792 | -0.48996 |
| J132 | 0.325 | -0.131 | 0.51616 | -0.04052 |
| J133 | 0.829 | -1.657 | 0.85480 | -1.05724 |
| J134 | 0.304 | 1.327 | 0.34971 | 0.38610 |
| J135 | 0.858 | -0.515 | 0.63125 | -0.33517 |
| J136 | 0.371 | -0.030 | 0.50421 | -0.01055 |
| J137 | 0.596 | 0.036 | 0.49270 | 0.01830 |
| J139 | 0.379 | 1.296 | 0.32315 | 0.45891 |
| J140 | 0.426 | -0.078 | 0.51217 | -0.03051 |
| J141 | 0.571 | -0.975 | 0.68570 | -0.48370 |
| J142 | 0.451 | -0.161 | 0.52634 | -0.06607 |
| J143 | 0.591 | -0.392 | 0.57902 | -0.19939 |
| J144 | 0.387 | -0.688 | 0.59805 | -0.24830 |
| J145 | 0.635 | -0.767 | 0.65958 | -0.41132 |
| J146 | 0.888 | -0.236 | 0.56220 | -0.15655 |
| J147 | 0.335 | 0.079 | 0.49004 | 0.02497 |
| J148 | 0.525 | -0.354 | 0.56529 | -0.16440 |
| J149 | 0.514 | -0.399 | 0.57238 | -0.18244 |
| J150 | 0.517 | -0.331 | 0.56043 | -0.15206 |
| J151 | 0.465 | 0.607 | 0.39885 | 0.25632 |
| J152 | 0.397 | 0.182 | 0.47322 | 0.06718 |
| J153 | 0.387 | 1.720 | 0.26737 | 0.62079 |
| J154 | 0.244 | 2.041 | 0.31430 | 0.48370 |
| J155 | 0.744 | 0.955 | 0.28420 | 0.57041 |
| J156 | 0.660 | 1.163 | 0.26073 | 0.64110 |

To be more specific, for the three pairs of adjacent tests, A5 and A6, A6 and J1, and J1 and J2, there are 16, 16 and 20 such overlapping test items, respectively. Table 6-1 presents the two item numbers, which are expressed in the notation adopted in the present study, of each item which belongs to the two adjacent tests of each pair.

If we can find the best fitted line for the scatter diagram of the estimated difficulty parameters with respect to these overlapping items, then we shall be able to obtain the estimated distance between the means of the two ability distributions, and the ratio of the standard deviations of these two distributions. If we follow a similar procedure for the estimated discrimination parameters with the constraint that the fitted line pass (0,0) , then we shall obtain another estimate of the ratio of the standard deviations of the two ability distributions. Since in each scatter diagram both sets of observations include error, it is obvious that a simple linear regression method for fitting a linear relationship between the two sets of estimates is not appropriate. There have been developed many methods (e.g., Deming, 1943) which deal with such a situation, however. In the present study, we shall use an iterative method based upon the dominating principal component obtained for the two sets of observations.

Let $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ be two sets of estimated item discrimination parameters obtained upon the examinee groups 1 and 2, respectively, where $g$ $(=1,2,\dots,m)$ indicates an overlapping test item. Since the discrimination parameter, $a_g$ , is proportional to

## TABLE 6-1

Three Sets of Overlapping Test Items between Adjacent Tests.

| | Tests A5 & A6 | | Tests A6 & J1 | | Tests J1 & J2 | |
|---|---|---|---|---|---|---|
| 1 | A533 | A601 | A641 | J101 | J137 | J201 |
| 2 | A534 | A602 | A642 | J102 | J138 | J202 |
| 3 | A535 | A603 | A643 | J103 | J139 | J203 |
| 4 | A536 | A604 | A644 | J104 | J140 | J204 |
| 5 | A537 | A605 | A645 | J105 | J141 | J205 |
| 6 | A538 | A606 | A646 | J106 | J142 | J206 |
| 7 | A539 | A607 | A647 | J107 | J143 | J207 |
| 8 | A540 | A608 | A648 | J108 | J144 | J208 |
| 9 | A541 | A609 | A649 | J109 | J145 | J209 |
| 10 | A542 | A610 | A650 | J110 | J146 | J210 |
| 11 | A543 | A611 | A651 | J111 | J147 | J211 |
| 12 | A544 | A612 | A652 | J112 | J148 | J212 |
| 13 | A545 | A613 | A653 | J113 | J149 | J213 |
| 14 | A546 | A614 | A654 | J114 | J150 | J214 |
| 15 | A547 | A615 | A655 | J115 | J151 | J215 |
| 16 | A548 | A616 | A656 | J116 | J152 | J216 |
| 17 | | | | | J153 | J217 |
| 18 | | | | | J154 | J218 |
| 19 | | | | | J155 | J219 |
| 20 | | | | | J156 | J220 |

the slope of the item characteristic function at $\theta = b_g$ both in the normal ogive and in the logistic models, without considering the error of estimation we can write

$$(6.1) \qquad a_{g2} = (\sigma_2/\sigma_1)\, a_{g1} \quad ,$$

where $\sigma_1$ and $\sigma_2$ represent the standard deviations of the ability distributions of the examinee groups 1 and 2, respectively. Thus the second principal component of the two variables degenerates, and the first principal component provides us with the linear relationship between $\{a_{g1}\}$ and $\{a_{g2}\}$. With fallible data, however, this is not the case. It is well known that the first and second principal components of two random variables are their linear combinations which provide us with the maximum and minimum variances, respectively, with the constraint that the total variance stay the same. Thus we can take the first, dominating principal component as the best fitted linear relationship between $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ .

Let A be the (2x2) symmetric matrix of the cross-products of $\hat{a}_{g1}$ and $\hat{a}_{g2}$. Thus we can write

$$(6.2) \qquad A = \{\sum_{g=1}^{m} \hat{a}_{gi}\, \hat{a}_{gj}\} \qquad i,j = 1,2 \quad .$$

It is well known that the two eigenvalues, $\lambda_1$ and $\lambda_2$, of the matrix A equal the variances of the first and second principal components of $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ , respectively. Let y be the random vector of the two principal components, $y_1$ and $y_2$, of $\hat{a}_1 = \{\hat{a}_{g1}\}$ and $\hat{a}_2 = \{\hat{a}_{g2}\}$ $(g=1,2,\dots,m)$. Thus we have

$$(6.3) \qquad y' = \{y_1, y_2\} \quad ,$$

with

$$(6.4) \qquad \text{Var.}\ (y_t) = \lambda_t \qquad\qquad t = 1,2 \quad ,$$

and

$$(6.5) \qquad y = \Gamma' a \ ,$$

where $\Gamma$ is the (2x2) matrix whose columns are the two eigenvectors corresponding to the two eigenvalues, $\lambda_1$ and $\lambda_2$, respectively, and $\hat{a}_g$ is the random vector of order 2 such that

$$(6.6) \qquad \hat{a}' = (\hat{a}_1,\ \hat{a}_2) \quad .$$

It is well known that, when $\Gamma$ is a (2x2) matrix, we can write

$$(6.7) \qquad \Gamma = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \quad ,$$

where $\alpha$ is the angle of the rotated axis specified by the first principal component with the axis representing $a_1$. Thus we have

$$(6.8) \quad \begin{cases} y_1 = \hat{a}_1 \cos \alpha + \hat{a}_2 \sin \alpha \\ y_2 = -\hat{a}_1 \sin \alpha + \hat{a}_2 \cos \alpha \end{cases} .$$

Let $u_1$ be the eigenvector corresponding to the eigenvalue $\lambda_1$. We can write, therefore,

$$(6.9) \quad u_1' = (u_{11}, u_{12}) = (\cos \alpha, \sin \alpha) .$$

The estimate of the two standard deviations is given by

$$(6.10) \quad \hat{\sigma}_2/\hat{\sigma}_1 = \tan \alpha = u_{12}/u_{11} .$$

Thus all we need is to compute the cross-products of $\hat{a}_{g1}$ and $\hat{a}_{g2}$ and produce the matrix A, to find out the eigenvector $u_1$ corresponding to its first, dominating eigenvalue, $\lambda_1$, of the matrix A, and take the ratio of the first element of the eigenvector $u_1$ to its second element.

We notice, however, in the above method that equal weights are put upon the error in $\hat{a}_1$ and upon the error in $\hat{a}_2$, which is not justifiable in the present situation, since the values of $\hat{a}_{g1}$ and $\hat{a}_{g2}$ are not determined on the same ability scale. To be more specific, if the unit of the scale is larger, then the values of the estimated discrimination parameters and their errors will also become larger, and vice versa. In minimizing the sum of the squared discrepancies from the first, dominating principal component, $y_1$, therefore, the set of $\hat{a}_{gi}$ which is based upon the larger scale unit is more heavily penalized.

To ameliorate this situation, let us consider the following logic. Suppose that the ratio, $\sigma_2/\sigma_1$, is known, and we define the weight $w$ in such a way that

$$w = \sigma_1/\sigma_2 , \tag{6.11}$$

and we further define

$$a^*_{gi} \begin{cases} = a_{g1} & i=1 \\ = wa_{g2} & i=2 \end{cases} . \tag{6.12}$$

It is noted that, unlike $a_{g1}$ and $a_{g2}$, $a^*_{g1}$ and $a^*_{g2}$ are comparable. We further define the (2x2) matrix $A^*$ such that

$$A^* = \{ \sum_{g=1}^{m} a^*_{g1}a^*_{g2} \} = \begin{bmatrix} \sum_{g=1}^{m} a_{g1}^2 & w\sum_{g=1}^{m} a_{g1}a_{g2} \\ w\sum_{g=1}^{m} a_{g1}a_{g2} & w^2\sum_{g=1}^{m} a_{g2}^2 \end{bmatrix} \tag{6.13}$$

It is easy to see that the matrix $A^*$ can be obtained directly from the matrix $A$, which is given by (6.2), by multiplying both its second row and second column by $w$. The two principal components, $y^*_1$ and $y^*_2$, of $a^*_1 = \{a^*_{g1}\}$ and $a^*_2 = \{a^*_{g2}\}$ $(g=1,2,\dots,m)$ are given by

$$(6.14)\qquad \begin{cases} y_1^* = a_1^* \cos \alpha^* + a_2^* \sin \alpha^* \\ y_2^* = -a_1^* \sin \alpha^* + a_2^* \cos \alpha^* \end{cases} ,$$

where $\cos \alpha^*$ and $\sin \alpha^*$ are obtained as the two elements of the eigenvector, $u_1^* = (u_{11}^*, u_{12}^*)$, corresponding to the first, dominating eigenvalue, $\lambda_1^*$, of the matrix $A^*$. Thus we can write

$$(6.15)\qquad u_1^{*\prime} = (u_{11}^*, u_{12}^*) = (\cos \alpha^*, \sin \alpha^*) ,$$

and

$$(6.16)\qquad \tan \alpha^* = u_{12}^*/u_{11}^* .$$

From this result, we obtain

$$(6.17)\qquad \tan \alpha = (\tan \alpha^*)/w = (u_{12}^*/u_{11}^*)\,(\sigma_2/\sigma_1) .$$

Since, in practice, $(\sigma_2/\sigma_1)$ is not known, the estimated ratio $(\hat{\sigma}_2/\hat{\sigma}_1)$ obtained by (6.10) can be used as its initial estimate, and the cycle of formulae (6.11) through (6.17) can be repeated, until $(u_{12}^*/u_{11}^*)$ converges to unity.

The situation is somewhat different if we use the sets of estimated difficulty parameters of the overlapping items for the equating purposes. Let $\{b_{g1}\}$ and $\{b_{g2}\}$ $(g=1,2,\ldots,m)$ be the two sets of estimated item difficulty parameters of the $m$

overlapping test items obtained upon the examinee groups 1 and 2, respectively. Since the difficulty parameter $b_g$ is the point of $\theta$ at which the conditional probability for answering the item correctly is 0.5, without considering the error of estimation we can write

$$(6.18)\qquad b_{g2} = (\sigma_1/\sigma_2)\, b_{g1} + (\mu_1-\mu_2)/\sigma_2 \quad ,$$

where $\mu_1$ and $\mu_2$ are the means of the two ability distributions of the examinee groups 1 and 2, respectively. Thus unlike the case of the item discrimination parameter the best fitted line for the scatter diagram of the estimated difficulty parameters does not include the origin, unless $\mu_1 = \mu_2$. For this reason, it will be appropriate to shift the origins of $b_{g1}$ and $b_{g2}$ to their respective means, and follow the same process from there. Thus we must use the covariance matrix B such that

$$(6.19)\qquad B = \{ \sum_{g=1}^{m} [b_{gi} - \frac{1}{m} \sum_{h=1}^{m} \hat{b}_{hi}][\hat{b}_{gj} - \frac{1}{m} \sum_{h=1}^{m} \hat{b}_{hj}] \}$$

$$i,j = 1,2 \quad ,$$

instead of the matrix of cross-products as we did for the scatter diagrams of estimated item discrimination parameters. Following the same iterative procedure by defining the matrix $B^*$ and using it in place of $A^*$, which is obtained by multiplying the second row and the second column of the matrix B by the weight $v$ such that

(6.20) $$v = \sigma_2/\sigma_1 = \tan \alpha ,$$

we obtain the estimate of $\cot \alpha$ which equals the ratio, $(\sigma_1/\sigma_2)$. Note that this ratio is given as the slope of the fitted linear relationship between $\{b_{g1}\}$ and $\{b_{g2}\}$, as is obvious from (6.18).

It is indicated in (6.18) that the intercept of the fitted linear relationship between $\{b_{g1}\}$ and $\{b_{g2}\}$ can be used as the estimated distance of $\mu_1$ from $\mu_2$ measured with $\sigma_2$ as the unit. If we wish to obtain the estimate of the distance of $\mu_2$ from $\mu_1$ with $\sigma_1$ as the unit of measurement, then we can simply multiply this intercept by $(-1)$, and then divide the result by the slope of the fitted line.

Figure 6-1 presents the three scatter diagrams of $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ for the overlapping test items in the A5/0599 and A6/0412 Cases, in the A6/0412 and J1/0614 Cases, and in the J1/0614 and J2/0758 Cases, together with the three similar scatter diagrams between J1/0614 and J1/1075 Cases, between J1/0614 and J1/2259 Cases, and between J1/1075 and J1/2259 Cases, respectively. Note that in the last three pairs of cases all the 55 items of Test J1 are treated as the overlapping items. In each of these six graphs, the best fitted line obtained by the iterative method described earlier in this section is shown by a thin, solid line. In the process of fitting these lines, however, those dots circled in the graphs were excluded, in order to hold some consistency with the corresponding estimation

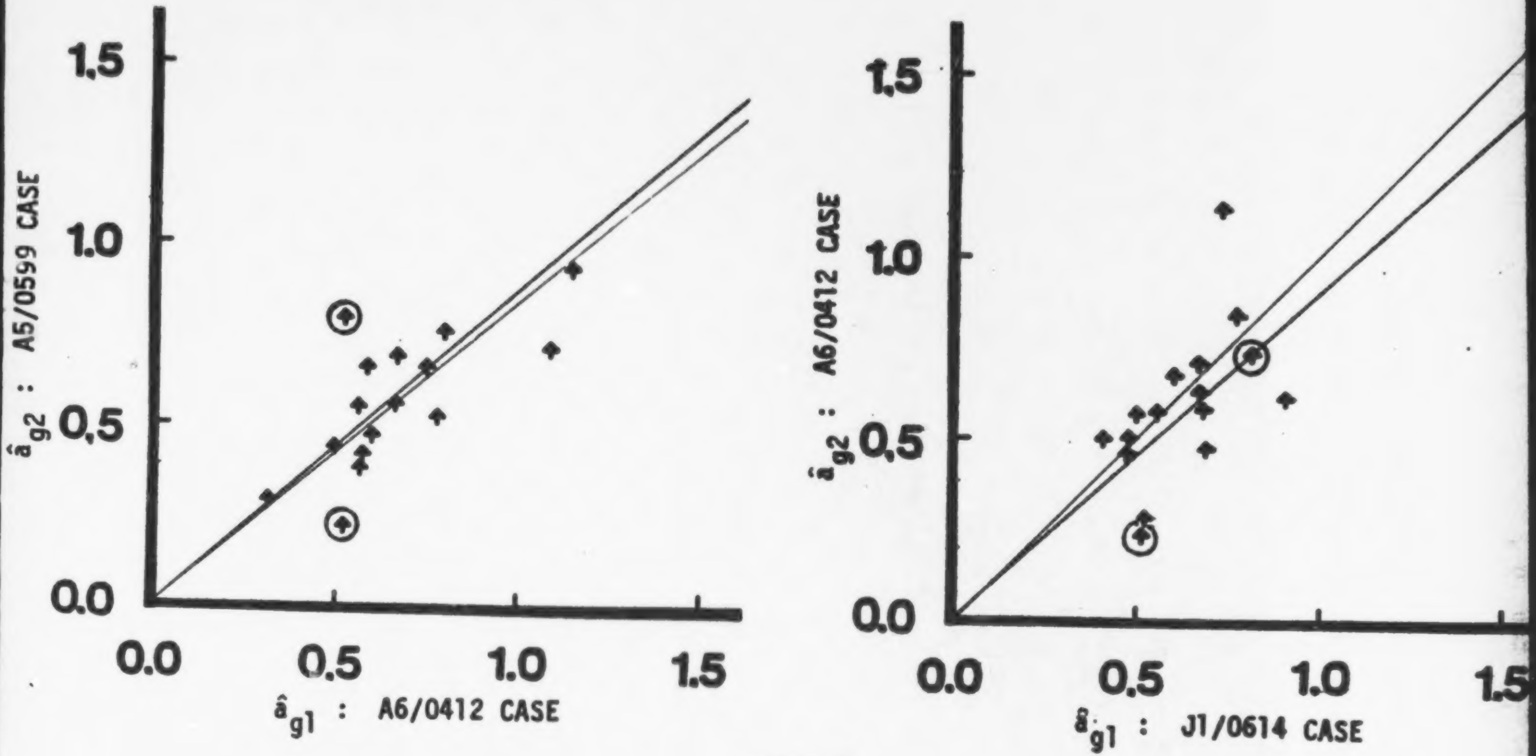

FIGURE 6-1

Two Sets of Estimated Item Discrimination Parameters of the Items Commonly Included by Two Adjacent Tests Which Were Obtained by the Tetrachoric Method. Fitted Linear Relationships Based upon Those Two Sets of Points (Thin Line) and upon Those and the Corresponding Two Sets of Estimated Difficulty Parameters (Thick Line) Are Also Shown. Circled Points Are Not Included in Line Fitting. The Graph on the Left Hand Side Shows 16 Common Items in Tests A5 and A6, Based upon the A5/0599 Case ( $a_{g2}$ ) and A6/0412 Case ( $a_{g1}$ ), Respectively, and the Graph on the Right Hand Side Shows 16 Common Items in Tests A6 and J1 Based upon the A6/0412 Case ( $a_{g2}$ ) and J1/0614 Case ( $a_{g1}$ ), Respectively.

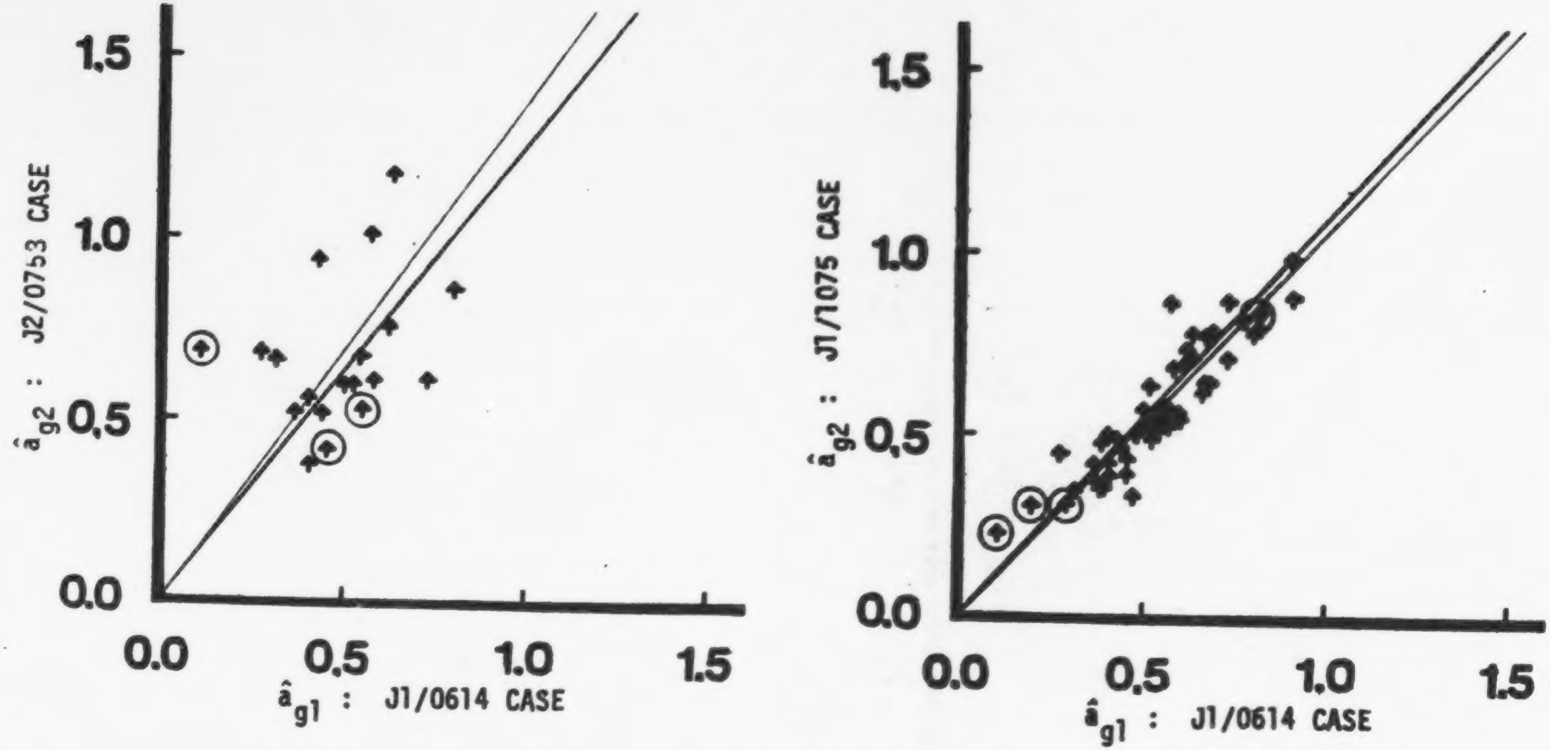

FIGURE 6-1 (Continued)

19 Common Items in Tests J1 and J2 Based upon the J1/0614 Case ( $a_{g1}$ ) and J2/0758 Case ( $a_{g2}$ ), Respectively.

55 Common Items in Test J1 Based upon the J1/0614 Case ( $a_{g1}$ ) and J1/1075 Case ( $a_{g2}$ ), Respectively.

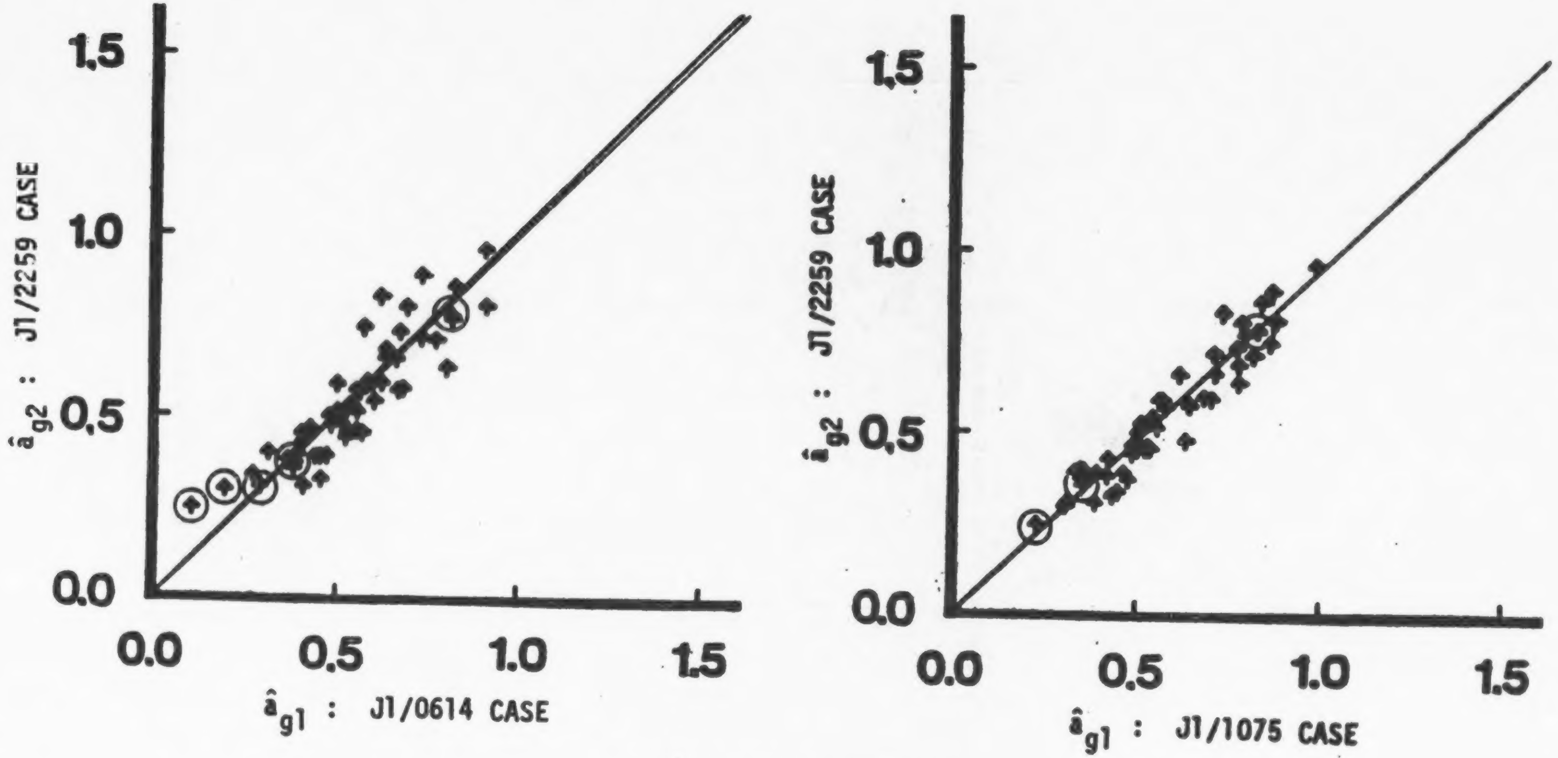

FIGURE 6-1 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case ( $a_{g1}$ ) and J1/2259 Case ( $a_{g2}$ ), Respectively.

55 Common Items in Test J1 Based upon the J1/1075 Case ( $a_{g1}$ ) and J1/2259 Case ( $a_{g2}$ ), Respectively.

based upon the scatter diagrams of the estimated difficulty parameters. The criterion for this exclusion will be explained in the subsequent paragraph. The slope and intercepts of each of these six fitted linear relationships between the two sets of estimated discrimination parameters are shown in the third and fourth columns of Table 6-2, respectively. We can see that the estimated intercept is close to zero in each case, the result which was expected from theory.

Figure 6-2 presents the corresponding six scatter diagrams of $\{b_{g1}\}$ and $\{b_{g2}\}$. Again in each graph the best fitted line is drawn by a thin, solid line. It is observed in these graphs that some of the estimated difficulty parameters are largely deviated from the rest. Since it is intrinsic in the Tetrachoric Method that those deviated values include large errors, all the dots having, at least, one estimated difficulty parameter outside the range of $[-2.0, 2.0]$ were excluded in the process of fitting the linear relationship. Those excluded dots are circled in Figure 6-2. The same items were also excluded in the process of fitting the line for the scatter diagrams of the estimated item discrimination parameters, and these are represented by the encircled dots in Figure 6-1. The slope and intercept of each of the six fitted relationships between the two sets of estimated difficulty parameters are shown in the sixth and seventh columns of Table 6-2, respectively.

Since, for each pair, we obtained two estimates of the ratio of the standard deviations of the ability distributions of the two examinee groups, the geometric mean of the two estimates was computed,

TABLE 6-2

Slope And Intercept of Each of the Fitted Linear Relationships between the Two Sets of Estimated Item Parameters $a_g$ or $b_g$ of the Common Test Items Based upon the Examinee Groups 1 and 2.

| Examinee Group 1 | Examinee Group 2 | $a_g$ | | Combined | $b_g$ | | Combined | |
|---|---|---|---|---|---|---|---|---|
| | | Slope | Intercept | Slope | Slope | Intercept | Slope | Intercept |
| A6/0412 | A5/0599 | 0.834 | 0.004 | 0.868 | 1.106 | 0.606 | 1.152 | 0.634 |
| J1/0614 | A6/0412 | 1.014 | -0.016 | 0.901 | 1.250 | 0.581 | 1.110 | 0.486 |
| J1/0614 | J2/0758 | 1.376 | -0.001 | 1.254 | 0.875 | -1.213 | 0.797 | -1.171 |
| J1/0614 | J1/1075 | 1.055 | -0.002 | 1.089 | 0.889 | -0.272 | 0.918 | -0.263 |
| J1/0614 | J1/2259 | 1.000 | -0.004 | 1.009 | 0.983 | -0.294 | 0.992 | -0.292 |
| J1/1075 | J1/2259 | 0.948 | -0.002 | 0.945 | 1.061 | -0.036 | 1.058 | -0.038 |

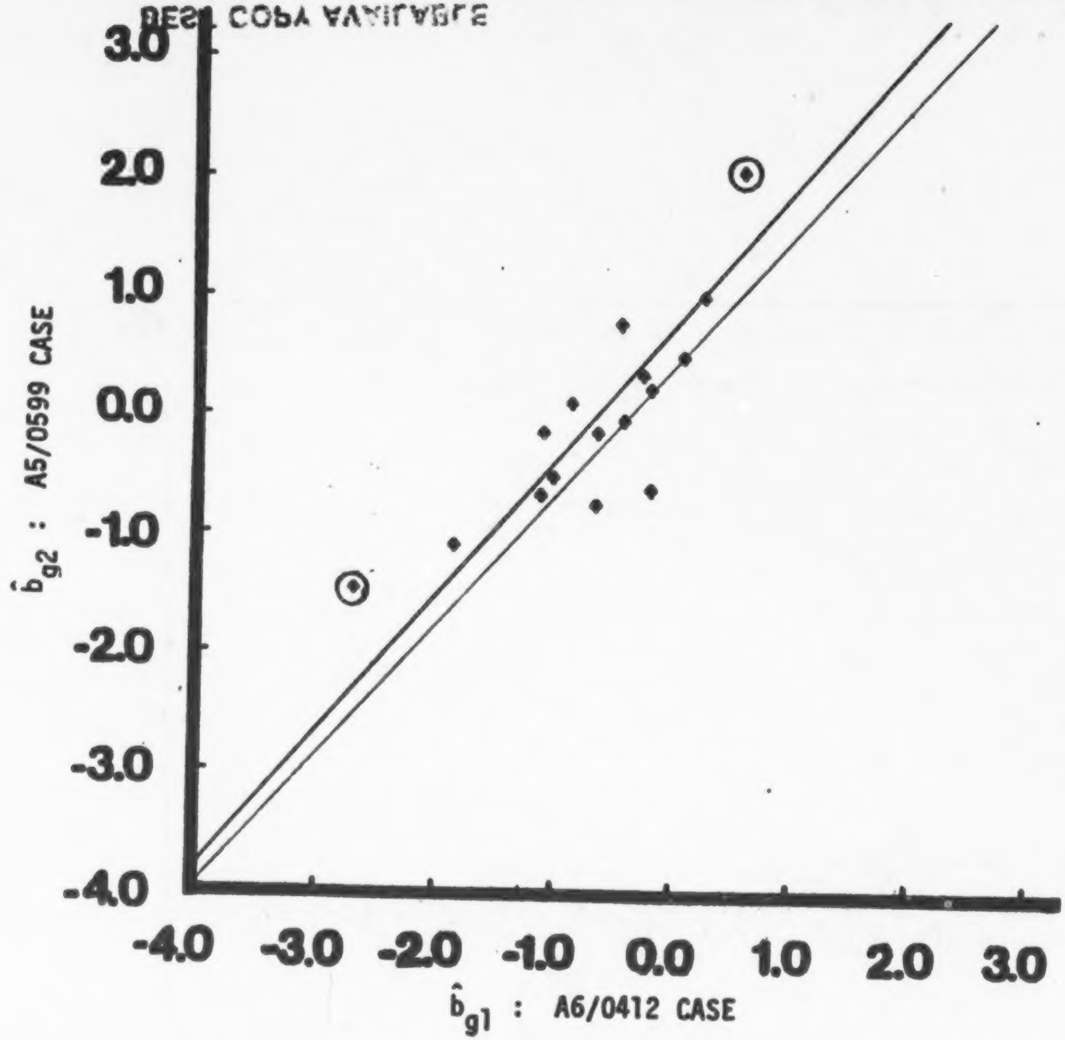

FIGURE 6-2

Two Sets of Estimated Item Difficulty Parameters of the Items Commonly Included by Two Adjacent Tests Which Were Obtained by the Tetrachoric Method. Fitted Linear Relationships Based upon Those Two Sets of Points (Thin Line) and upon Those and the Corresponding Two Sets of Estimated Discrimination Parameters (Thick Line) Are Also Shown. Circled Points Are Not Included in Line Fitting. 16 Common Items in Tests A5 and A6, Based upon the A5/0599 Case ( $b_{g2}$ ) and A6/0412 Case ( $\hat{b}_{g1}$ ), Respectively.

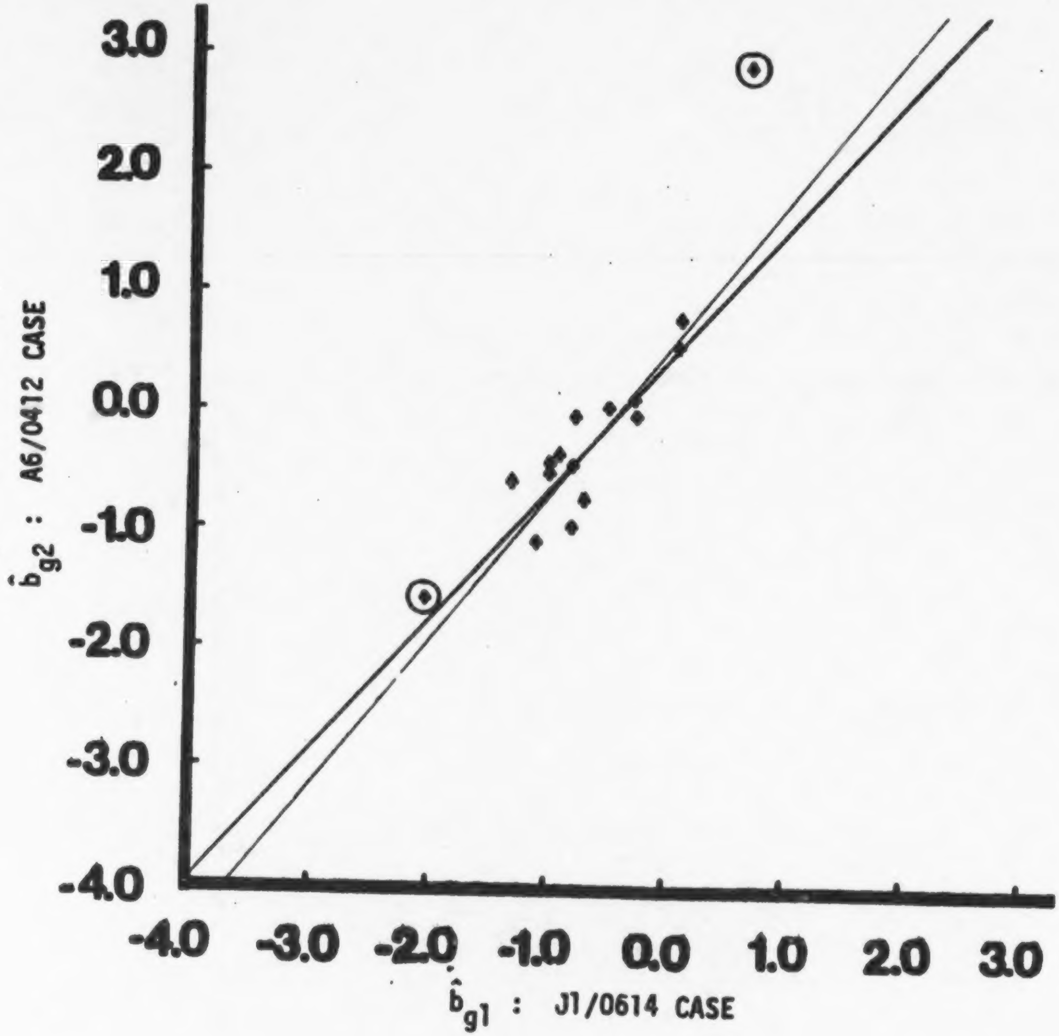

FIGURE 6-2 (Continued)

16 Common Items in Tests A6 and J1 Based upon the A6/0412 Case ( $b_{g2}$ ) and J1/0614 Case ( $b_{g1}$ ), Respectively.

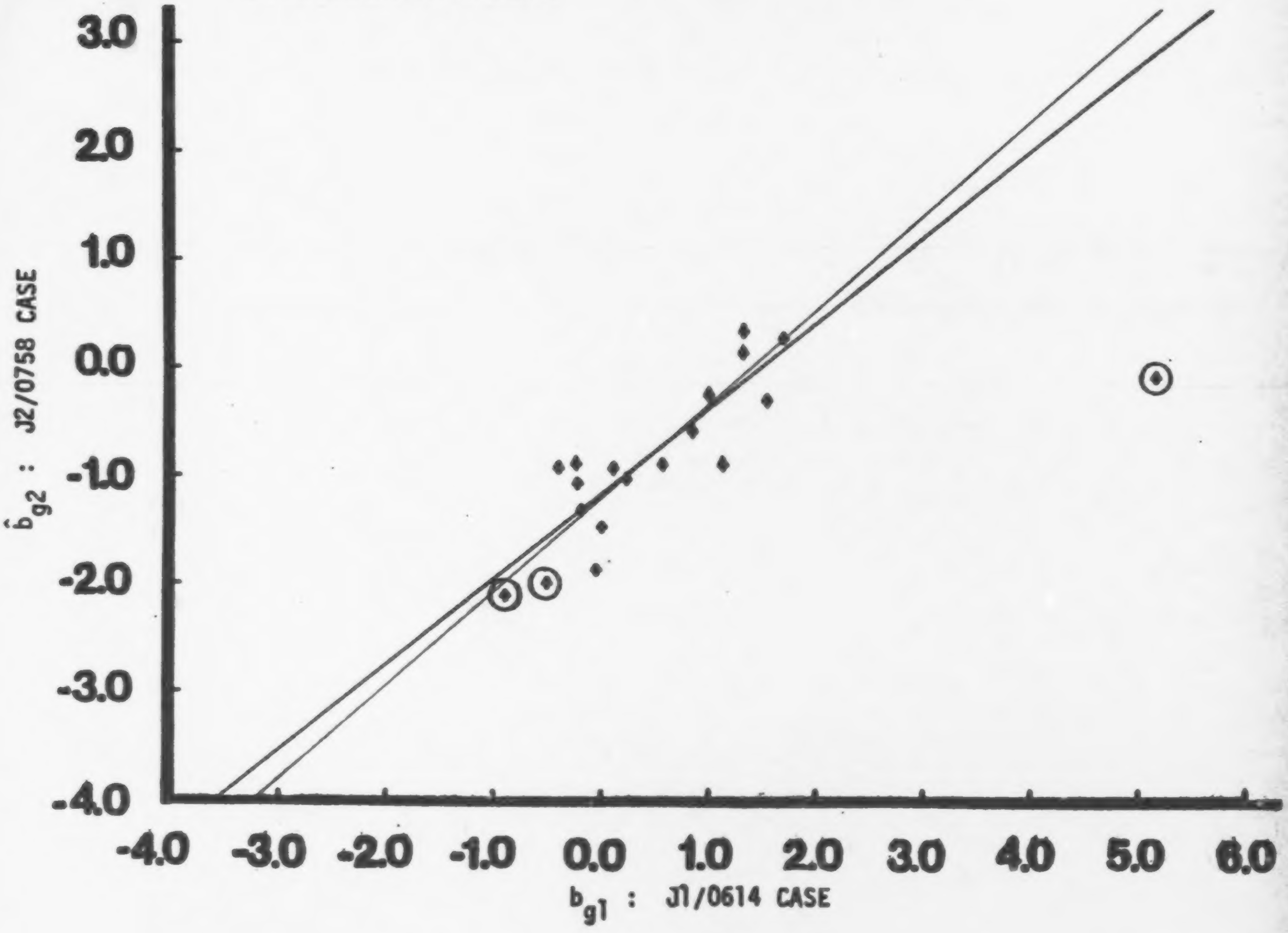

FIGURE 6-2 (Continued)

19 Common Items in Tests J1 and J2 Based upon the J1/0614 Case ( $b_{g1}$ ) and J2/0758 Case ( $b_{g2}$ ), Respectively.

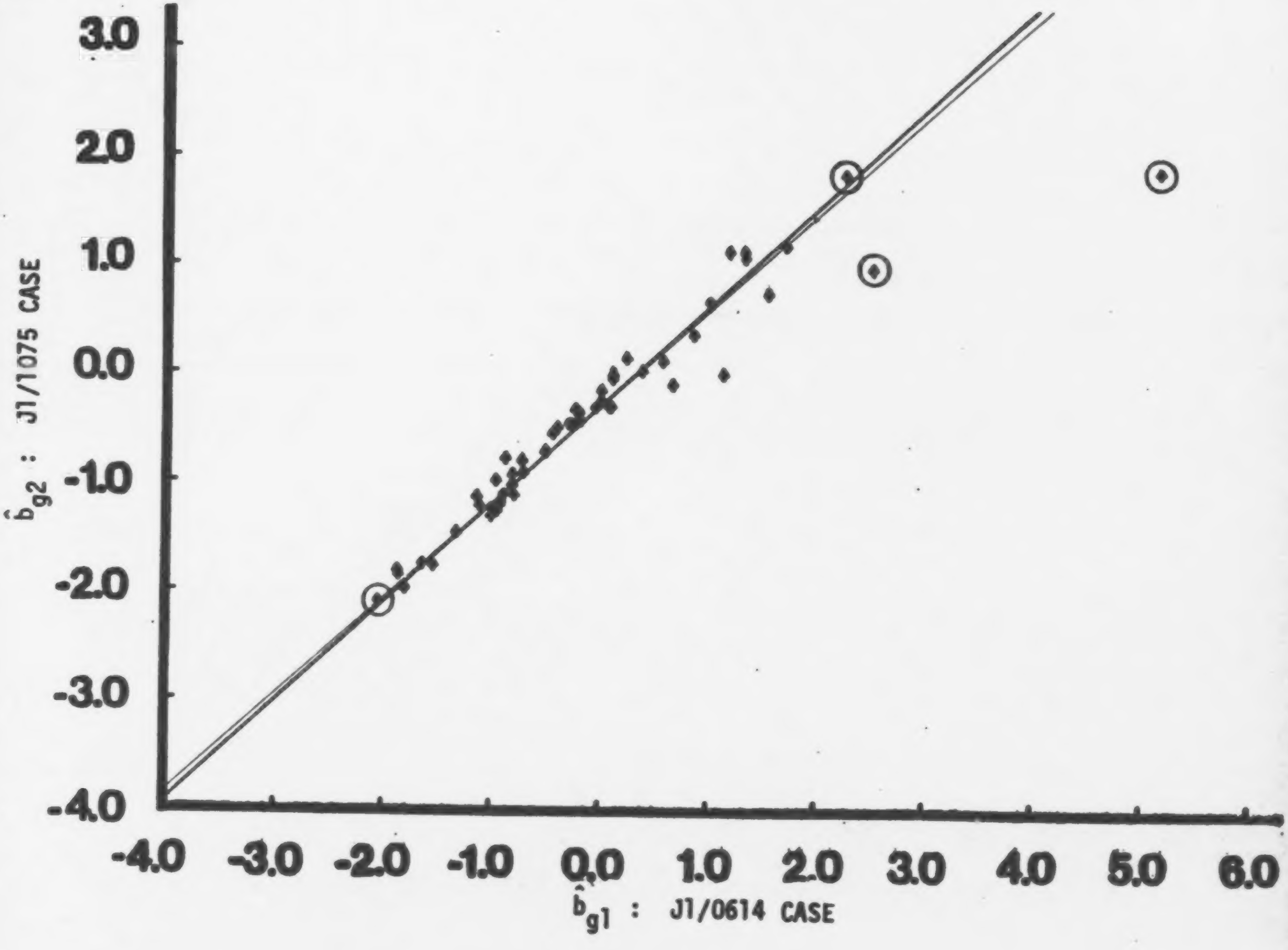

FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case ( $b_{g1}$ ) and J1/1075 Case ( $b_{g2}$ ), Respectively.

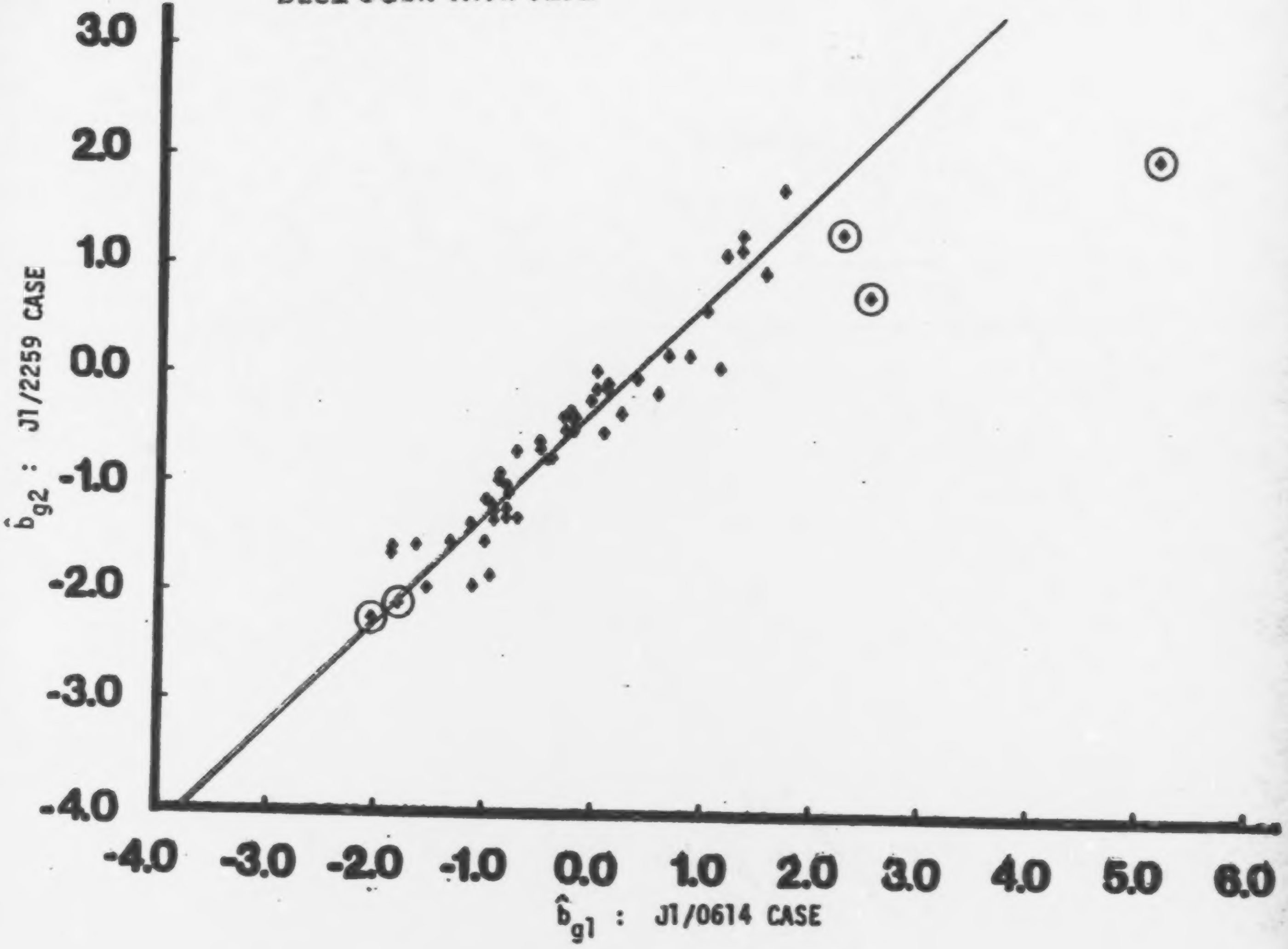

FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case ( $b_{g1}$ ) and J1/2259 Case ( $b_{g2}$ ), Respectively.

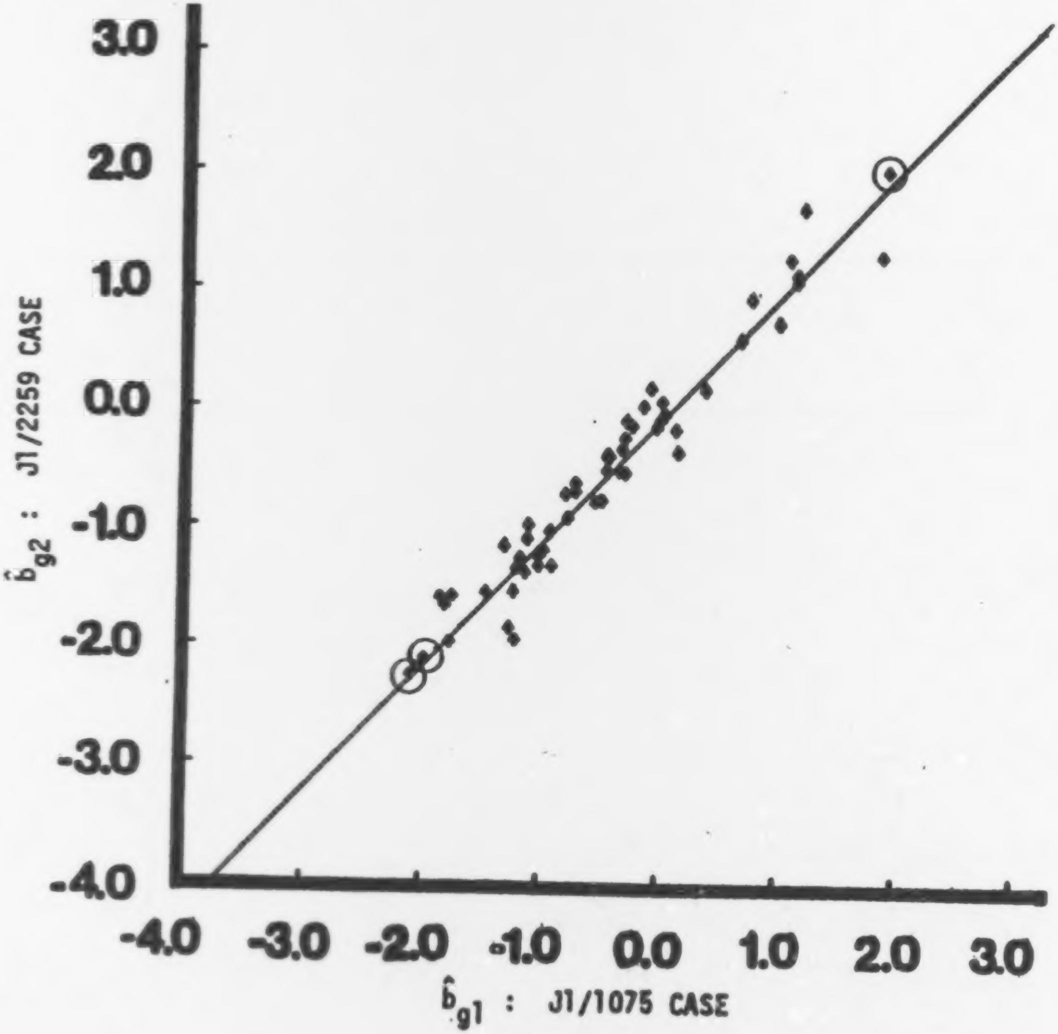

FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/1075 Case ( $b_{g1}$ ) and J1/2259 Case ( $b_{g2}$ ), Respectively.

and used as the ultimate estimate of the ratio. The resulting linear function is shown by a thick, solid line in each graph of Figures 6-1 and 6-2. Note that, in Figure 6-2, not only the slope of the line is different from the one for the dotted line, but its intercept was also changed accordingly. Table 6-2 presents the slope thus obtained for each pair of sets of estimated discrimination parameters in its fifth column, and the slope and intercept of each of the six combined linear relationships for the estimated difficulty parameters in the eigth and ninth columns. Main intermediate results in the process of obtaining these values are shown in Appendix as Table A-1.

In order to put all the six ability distributions on a single ability scale, the following procedure was taken. First, we must pick up one examinee group who has taken a specific test, and decide to use the mean and standard deviation of its ability distribution as the origin and unit of the single ability scale. Let us call this specific examinee group as Subject Set 1. We can write

$$(6.21) \qquad \frac{\mu_k-\mu_1}{\sigma_1} = \sum_{u=1}^{k-1}\left[\frac{\mu_{u+1}-\mu_u}{\sigma_u}\prod_{s=1}^{u}\frac{\sigma_s}{\sigma_{s-1}}\right]$$

with $\sigma_0 \equiv 1$ , and

$$(6.22) \qquad \sigma_k/\sigma_1 = \prod_{s=1}^{k-1}(\sigma_{s+1}/\sigma_s)$$

for Subject Set k (>1) . (6.21) and (6.22) indicate that the indirect comparisons of the mean and standard deviation of any examinee group with those of Subject Set 1 are possible through (k-2) other examinee groups. For example, if we choose J2/0758 Case as Subject Set 1, k = 4 for the A5/0599 Case, since this examinee group can indirectly be compared with Subject Set 1 through two more examinee groups, i.e., A6/0412 and J1/0614 Cases. Since both the estimate of the ratio of the standard deviations of the ability distributions of two examinee groups, who took two adjacent tests, and the estimate of the distance between their means measured by the standard deviation of either one of the two examinee groups are available, (6.21) and (6.22) will provide us with the estimated mean and standard deviation of the ability distribution of every examinee group which are based upon the single ability scale with its origin and unit set equal to the mean and standard deviation of the ability distribution of Subject Set 1.

In the present study, our choice of Subject Set 1 is J1/0614 Case. Table 6-3 presents in its first six rows the estimates of the mean and the standard deviation of the ability distribution thus obtained for each of the six examinee groups. In these five cases other than J1/0614, k = 3 in the A5/0599 Case, and k = 2 otherwise. Since J1/1075 and J2/2259 Cases are directly compared using this result and k = 3 , we obtained another set of estimates of the mean and the standard deviation for each case. These results are shown in the seventh and eighth rows of Table 6-3. We can see that they are reasonably close to the corresponding results obtained by the direct

TABLE 6-3

Estimated Mean and Standard Deviation of Each of the Six Ability Distributions on the Ability Scale, Which Uses the Mean and the Standard Deviation of the J1/0614 Case As Its Origin and Unit, Respectively, and Those of Each of the Three Ability Distributions of the Combined Examinee Groups. Those Estimates Obtained Indirectly for the J1/1075 and J1/2259 Cases Are Also Shown.

| Examinee Group | Mean | S.D. |
|---|---|---|
| A5/0599 | -0.9335053873988D 00 | 0.7821682606788D 00 |
| A6/0412 | -0.4377494503856D 00 | 0.9007008047842D 00 |
| J1/0614 | 0.0000000000000D 00 | 0.1000000000000D 01 |
| J2/0758 | 0.1468885831893D 01 | 0.1253937346912D 01 |
| J1/1075 | 0.2865059655582D 00 | 0.1089166526997D 01 |
| J1/2259 | 0.2945629608377D 00 | 0.1008543903576D 01 |
| J1/1075(2259) | 0.2566381868855D 00 | 0.1066889245353D 01 |
| J1/2259(1075) | 0.3252226313344D 00 | 0.1029602899800D 01 |
| A5-A6 | -0.7314762617317D 00 | 0.8674202978083D 00 |
| J1-J2 | 0.7754551956083D 00 | 0.1298071512414D 01 |
| A5-A6-J1-J2 | 0.2397633167859D 00 | 0.1368853296181D 01 |

comparisons with the J1/0614 Case, or with $k = 2$ .

Since in using Logist 5 we produced three combined examinee groups, i.e., the combinations of A5/0599 and A6/0412 Cases, of the J1/1075 and J2/0758 Cases and of the A5/0599, A6/0412, J1/1075 and J2/0758 Cases, it is necessary to estimate the mean and the standard deviation of the ability distribution of each of these three combined examinee groups. We can write for the density function $f(\theta)$ , the mean $E(\theta)$ and the variance Var. $(\theta)$ of any combined distribution

$$(6.23) \qquad f(\theta) = \sum_{i=1}^{M} p_i f_i(\theta) \quad ,$$

$$(6.24) \qquad E(\theta) = \sum_{i=1}^{M} p_i \int_{-\infty}^{\infty} f_i(\theta)\, d\theta = \sum_{i=1}^{n} p_i E_i(\theta)$$

and

$$(6.25) \qquad \mathrm{Var.}(\theta) = \sum_{i=1}^{M} p_i \int_{-\infty}^{\infty} \theta^2 f_i(\theta) d\theta - [E(\theta)]^2 \quad ,$$

$$= \sum_{i=1}^{M} p_i \, \mathrm{Var.}_i(\theta) + \sum_{i=1}^{M} p_i \, [E_i(\theta)]^2 - [E(\theta)]^2 \quad ,$$

where $M$ is the number of original distributions involved, $p_i$ is the probability assigned to the original population $i$ , $f_i(\theta)$ is the density function for population $i$ , and $E_i(\theta)$ and Var. $_i(\theta)$ are the mean and the variance of the ability distribution of the population $i$ , respectively. Using the estimated mean and standard deviation of the ability distribution of each examinee group involved and the proportion of the examinees of such a group $i$ to those of the combined group as the estimate of $p_i$ , we can obtain the estimated mean and standard deviation of each combined examinee group Through (6.24) and (6.25). These results are also shown in the last three rows of Table 6-3. The estimated ability distribution of each of the original and the combined examinee groups is also presented in Figure 6-3.

Tables 6-4 through 6-9 present the estimated item discrimination and difficulty parameters of each item of Tests A5, A6, J1 and J2, which were obtained by the Tetrachoric Method used for the A5/0599, A6/0412, J1/0614 and J2/0758 Cases, and then readjusted to this single ability scale, together with the two additional sets of estimated item parameters of the 55 items of Test J1 obtained upon the J1/1075 and J1/2259 Cases. In these tables, all the estimated item discrimination parameters and difficulty parameters which are less than 0.100 and exceed 3.000 in absolute value, respectively, are marked with ● .

## VII. Item Parameters Estimated by Logist 5

As was mentioned in Section 3, in using Logist 5 we combined two or more examinee groups, who took different tests having some overlapping items, in order to provide us with the larger samples of examinees in the effort of increasing the accuracy of estimation. There are three such cases, and they are described in Table 3-2 of Section 3. For brevity, hereafter we shall call them Case A5-A6, Case J1-J2 and Case A5-A6-J1-J2, respectively, indicating the tests

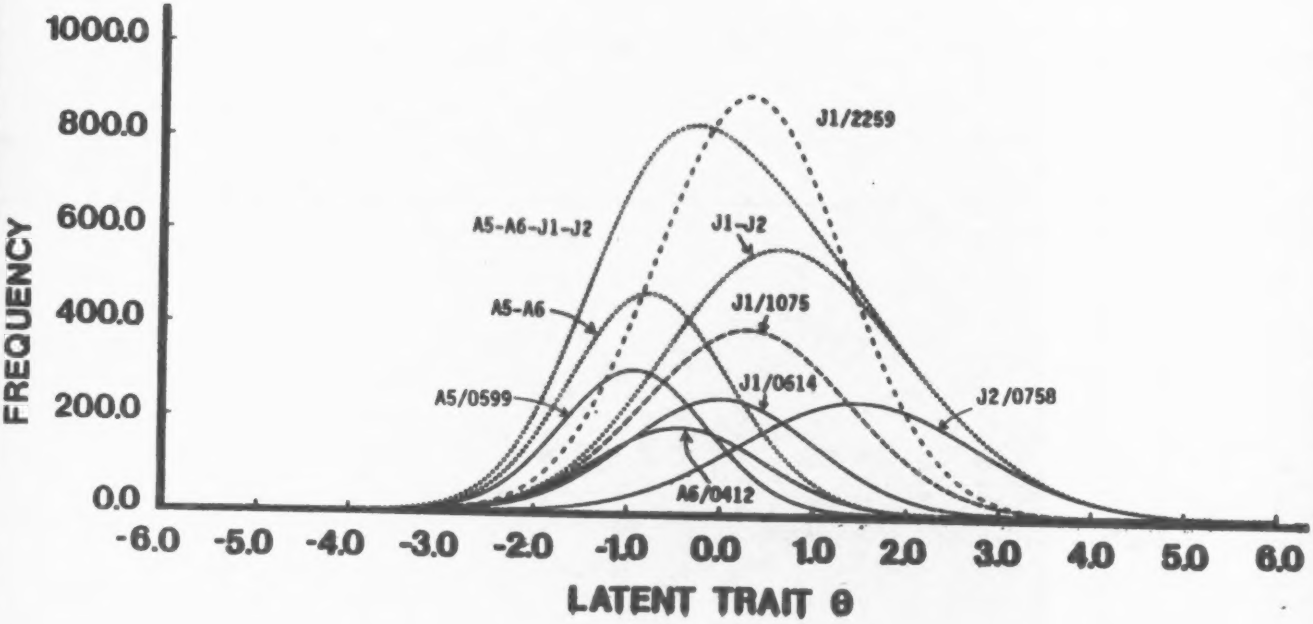

FIGURE 6-3

Estimated Ability Distributions (Solid Lines) of the A5/0599, A6/0412, J1/0614 And J2/0758 Cases, Those of the J1/1075 Case (Long Dashed Line) And of the J1/2259 Case (Short Dashed Line), Together with Those (Dotted Lines) of the Combined Examinee Groups, A5-A6 , J1-J2 And A5-A6-J1-J2.

## TABLE 6-4

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Based upon the Tetrachoric Method Applied for the A5/0599 Case. After the Scale Adjustment Was Made.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.822 | -2.292 |
| A502 | 0.597 | -3.188 ● |
| A503 | --- | --- |
| A504 | 0.730 | -2.038 |
| A505 | 0.849 | -2.405 |
| A506 | 0.559 | -1.989 |
| A507 | 0.542 | -0.994 |
| A508 | 0.873 | -1.821 |
| A509 | 1.356 | -1.997 |
| A510 | 0.758 | -0.949 |
| A511 | 0.589 | -2.092 |
| A512 | 0.759 | -1.929 |
| A513 | --- | --- |
| A514 | 0.993 | -1.864 |
| A515 | 0.575 | -2.249 |
| A516 | 0.486 | 0.498 |
| A517 | --- | --- |
| A518 | 0.433 | -2.494 |
| A519 | 0.817 | -1.936 |
| A520 | 0.447 | -2.995 |
| A521 | 0.727 | -1.931 |
| A522 | 0.568 | -0.702 |
| A523 | 0.096 ● | 4.836 ● |
| A524 | 0.501 | -2.068 |
| A525 | 1.036 | -2.027 |
| A526 | 0.993 | -0.832 |
| A527 | 0.097 ● | -0.210 |
| A528 | 0.532 | -0.140 |
| A529 | 0.632 | -0.598 |
| A530 | 0.694 | -1.770 |
| A531 | -0.064 ● | -21.642 ● |
| A532 | 0.610 | -0.007 |
| A533 | 0.877 | -1.791 |
| A534 | 1.011 | -2.081 |
| A535 | 0.665 | -1.340 |
| A536 | 0.839 | -1.048 |
| A537 | 0.598 | -1.524 |
| A538 | 1.189 | -0.853 |
| A539 | 0.841 | -1.048 |
| A540 | 0.483 | -0.757 |
| A541 | 0.699 | -0.966 |
| A542 | 0.557 | -1.461 |
| A543 | 0.710 | -1.418 |
| A544 | 0.965 | -0.323 |
| A545 | 0.906 | -0.663 |
| A546 | 0.279 | 0.684 |
| A547 | 0.369 | -0.539 |
| A548 | 0.532 | -0.140 |

TABLE 6-5

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Based upon the Tetrachoric Method Applied for the A6/0412 Case. After the Scale Adjustment Was Made.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.737 | -2.115 |
| A602 | 0.574 | -2.869 |
| A603 | 0.862 | -1.364 |
| A604 | 0.645 | -1.442 |
| A605 | 0.662 | -1.036 |
| A606 | 1.269 | -1.228 |
| A607 | 0.827 | -1.026 |
| A608 | 0.626 | -0.621 |
| A609 | 0.620 | -0.826 |
| A610 | 0.546 | -1.457 |
| A611 | 0.733 | -0.618 |
| A612 | 0.882 | -0.857 |
| A613 | 1.205 | -0.683 |
| A614 | 0.576 | 0.070 |
| A615 | 0.344 | -0.377 |
| A616 | 0.633 | -0.220 |
| A617 | 0.908 | -1.719 |
| A618 | 0.554 | -1.265 |
| A619 | 0.623 | -1.266 |
| A620 | 1.027 | -0.623 |
| A621 | 0.892 | -1.013 |
| A622 | 0.606 | -1.810 |
| A623 | 0.502 | -1.553 |
| A624 | 0.613 | -2.264 |
| A625 | 0.446 | -1.885 |
| A626 | 0.564 | -1.093 |
| A627 | 0.361 | -0.525 |
| A628 | 0.239 | -3.050● |
| A629 | 0.695 | -0.676 |
| A630 | 0.701 | -1.029 |
| A631 | 0.656 | -0.880 |
| A632 | 0.663 | -1.509 |
| A633 | 0.425 | -1.243 |
| A634 | 1.025 | -1.792 |
| A635 | 0.785 | -2.435 |
| A636 | 0.705 | -1.748 |
| A637 | 0.527 | -1.173 |
| A638 | 0.467 | 0.770 |
| A639 | 0.038● | 19.949● |
| A640 | 0.623 | -0.217 |
| A641 | 0.697 | 0.070 |
| A642 | 0.747 | -1.309 |
| A643 | 0.785 | -0.906 |
| A644 | 1.257 | -0.474 |
| A645 | 0.524 | -0.332 |
| A646 | 0.556 | -0.840 |
| A647 | 0.628 | 0.276 |
| A648 | 0.814 | -1.870 |
| A649 | 0.508 | -0.827 |
| A650 | 0.643 | -0.402 |
| A651 | 0.678 | -0.974 |
| A652 | 0.312 | -1.104 |
| A653 | 0.635 | -0.765 |
| A654 | 0.258 | 2.190 |
| A655 | 0.930 | -0.466 |
| A656 | 0.553 | -1.428 |

## TABLE 6-6

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/0614 Case. After the Scale Adjustment Was Made.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.668 | 0.072 |
| J102 | 0.599 | -0.817 |
| J103 | 0.664 | -1.013 |
| J104 | 0.727 | -0.799 |
| J105 | 0.686 | -0.301 |
| J106 | 0.475 | -0.815 |
| J107 | 0.497 | 0.090 |
| J108 | 0.809 | -2.051 |
| J109 | 0.470 | -1.011 |
| J110 | 0.678 | -0.517 |
| J111 | 0.901 | -1.329 |
| J112 | 0.521 | -0.714 |
| J113 | 0.553 | -0.930 |
| J114 | 0.513 | 0.657 |
| J115 | 0.767 | -0.279 |
| J116 | 0.406 | -1.117 |
| J117 | 0.390 | -0.880 |
| J118 | 0.594 | -0.959 |
| J119 | 0.659 | -0.926 |
| J120 | 0.191 | 2.502 |
| J121 | 0.482 | -0.967 |
| J122 | 0.524 | -0.819 |
| J123 | 0.552 | 0.103 |
| J124 | 0.560 | -1.863 |
| J125 | 0.567 | -1.541 |
| J126 | 0.383 | -0.727 |
| J127 | 0.531 | -1.643 |
| J128 | 0.630 | -1.144 |
| J129 | 0.812 | 1.174 |
| J130 | 0.379 | -1.805 |
| J131 | 0.905 | -0.447 |
| J132 | 0.454 | 0.000 |
| J133 | 0.614 | -1.873 |
| J134 | 0.287 | 2.244 |
| J135 | 0.819 | -0.205 |
| J136 | 0.371 | 0.374 |
| J137 | 0.580 | 0.000 |
| J138 | --- | --- |
| J139 | 0.362 | 1.321 |
| J140 | 0.403 | 0.107 |
| J141 | 0.549 | -0.894 |
| J142 | 0.400 | 0.566 |
| J143 | 0.620 | -0.190 |
| J144 | 0.452 | -0.510 |
| J145 | 0.798 | -0.401 |
| J146 | 0.727 | -0.051 |
| J147 | 0.267 | 1.125 |
| J148 | 0.542 | 0.231 |
| J149 | 0.499 | -0.224 |
| J150 | 0.524 | -0.237 |
| J151 | 0.424 | 0.999 |
| J152 | 0.309 | 0.847 |
| J153 | 0.438 | 1.696 |
| J154 | 0.100 | 5.150 |
| J155 | 0.569 | 1.536 |
| J156 | 0.630 | 1.313 |

## TABLE 6-7

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Based upon the Tetrachoric Method Applied for the J2/0758 Case. After the Scale Adjustment Was Made.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.484 | -0.393 |
| J202 | --- | --- |
| J203 | 0.412 | 1.879 |
| J204 | 0.298 | 0.289 |
| J205 | 0.419 | -1.197 |
| J206 | 0.444 | 0.335 |
| J207 | 0.601 | -0.198 |
| J208 | 0.331 | -1.050 |
| J209 | 0.685 | 0.295 |
| J210 | 0.486 | -0.892 |
| J211 | 0.543 | 0.333 |
| J212 | 0.535 | 0.164 |
| J213 | 0.473 | 0.116 |
| J214 | 0.475 | 0.342 |
| J215 | 0.747 | 1.139 |
| J216 | 0.528 | 0.719 |
| J217 | 0.411 | 1.797 |
| J218 | 0.546 | 1.336 |
| J219 | 0.804 | 1.080 |
| J220 | 0.936 | 1.633 |
| J221 | 0.359 | 1.896 |
| J222 | 0.575 | 0.654 |
| J223 | 0.368 | -0.476 |
| J224 | 0.556 | 0.614 |
| J225 | 0.549 | -0.078 |
| J226 | 0.549 | 0.650 |
| J227 | 0.529 | 0.221 |
| J228 | 0.532 | -0.270 |
| J229 | 0.521 | 0.092 |
| J230 | 0.481 | 0.133 |
| J231 | 0.953 | -0.052 |
| J232 | 0.710 | -0.173 |
| J233 | 0.282 | 2.146 |
| J234 | 0.308 | 1.504 |
| J235 | 0.775 | 0.678 |
| J236 | 0.731 | 0.801 |
| J237 | 0.226 | -0.051 |
| J238 | 0.707 | 2.358 |
| J239 | 0.430 | 1.231 |
| J240 | 0.552 | 1.777 |
| J241 | 0.817 | -0.003 |
| J242 | 0.609 | 0.291 |
| J243 | 0.328 | 0.480 |
| J244 | 0.287 | 1.135 |
| J245 | 0.691 | 1.316 |
| J246 | 0.222 | 1.609 |
| J247 | 0.431 | 1.206 |
| J248 | 0.322 | -0.741 |
| J249 | 0.593 | 1.112 |
| J250 | 0.572 | 0.995 |
| J251 | 0.723 | 0.293 |
| J252 | 0.471 | 1.395 |
| J253 | 0.477 | 1.493 |
| J254 | 0.489 | 1.421 |
| J255 | 0.914 | 1.552 |
| J256 | 0.464 | 2.067 |
| J257 | 0.429 | 1.071 |
| J258 | 0.362 | 1.621 |
| J259 | 0.658 | 1.706 |
| J260 | 0.073● | 3.692● |

## TABLE 6-8

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/1075 Case. After the Scale Adjustment Was Made.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.708 | -0.044 |
| J102 | 0.497 | -0.842 |
| J103 | 0.590 | -1.064 |
| J104 | 0.650 | -0.939 |
| J105 | 0.719 | -0.215 |
| J106 | 0.459 | -0.731 |
| J107 | 0.521 | -0.039 |
| J108 | 0.759 | -2.003 |
| J109 | 0.303 | -1.148 |
| J110 | 0.588 | -0.502 |
| J111 | 0.902 | -1.318 |
| J112 | 0.446 | -0.712 |
| J113 | 0.508 | -1.035 |
| J114 | 0.580 | 0.182 |
| J115 | 0.748 | -0.211 |
| J116 | 0.353 | -1.044 |
| J117 | 0.325 | -0.569 |
| J118 | 0.513 | -1.100 |
| J119 | 0.564 | -1.001 |
| J120 | 0.277 | 1.357 |
| J121 | 0.458 | -0.789 |
| J122 | 0.491 | -0.835 |
| J123 | 0.484 | 0.237 |
| J124 | 0.529 | -1.738 |
| J125 | 0.479 | -1.648 |
| J126 | 0.436 | -0.590 |
| J127 | 0.498 | -1.627 |
| J128 | 0.712 | -0.957 |
| J129 | 0.728 | 1.518 |
| J130 | 0.322 | -1.879 |
| J131 | 0.805 | -0.317 |
| J132 | 0.396 | 0.017 |
| J133 | 0.672 | -1.693 |
| J134 | 0.281 | 2.299 |
| J135 | 0.768 | -0.101 |
| J136 | 0.337 | 0.316 |
| J137 | 0.626 | 0.119 |
| J138 | --- | --- |
| J139 | 0.384 | 1.453 |
| J140 | 0.386 | 0.273 |
| J141 | 0.530 | -0.928 |
| J142 | 0.458 | 0.417 |
| J143 | 0.644 | -0.187 |
| J144 | 0.357 | -0.501 |
| J145 | 0.713 | -0.257 |
| J146 | 0.794 | -0.050 |
| J147 | 0.410 | 0.287 |
| J148 | 0.468 | 0.443 |
| J149 | 0.472 | -0.206 |
| J150 | 0.473 | -0.076 |
| J151 | 0.446 | 1.012 |
| J152 | 0.316 | 0.685 |
| J153 | 0.425 | 1.579 |
| J154 | 0.206 | 2.345 |
| J155 | 0.790 | 1.097 |
| J156 | 0.653 | 1.518 |

## TABLE 6-9

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/2259 Case. After the Scale Adjustment Was Made.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.726 | -0.238 |
| J102 | 0.537 | -0.956 |
| J103 | 0.568 | -1.263 |
| J104 | 0.710 | -0.809 |
| J105 | 0.794 | -0.097 |
| J106 | 0.495 | -0.741 |
| J107 | 0.583 | 0.205 |
| J108 | 0.771 | -1.974 |
| J109 | 0.386 | -0.872 |
| J110 | 0.572 | -0.327 |
| J111 | 0.950 | -1.266 |
| J112 | 0.437 | -1.036 |
| J113 | 0.508 | -1.061 |
| J114 | 0.472 | 0.486 |
| J115 | 0.704 | -0.224 |
| J116 | 0.303 | -1.671 |
| J117 | 0.390 | -0.626 |
| J118 | 0.583 | -1.573 |
| J119 | 0.653 | -0.972 |
| J120 | 0.293 | 1.058 |
| J121 | 0.470 | -0.904 |
| J122 | 0.451 | -1.038 |
| J123 | 0.456 | 0.151 |
| J124 | 0.562 | -1.313 |
| J125 | 0.450 | -1.691 |
| J126 | 0.367 | -0.424 |
| J127 | 0.525 | -1.299 |
| J128 | 0.679 | -1.094 |
| J129 | 0.761 | 1.416 |
| J130 | 0.351 | -1.839 |
| J131 | 0.798 | -0.494 |
| J132 | 0.322 | 0.162 |
| J133 | 0.822 | -1.377 |
| J134 | 0.302 | 1.633 |
| J135 | 0.850 | -0.225 |
| J136 | 0.368 | 0.264 |
| J137 | 0.591 | 0.331 |
| J138 | --- | --- |
| J139 | 0.375 | 1.602 |
| J140 | 0.422 | 0.216 |
| J141 | 0.566 | -0.689 |
| J142 | 0.447 | 0.132 |
| J143 | 0.586 | -0.100 |
| J144 | 0.384 | -0.399 |
| J145 | 0.630 | -0.479 |
| J146 | 0.880 | 0.057 |
| J147 | 0.333 | 0.374 |
| J148 | 0.521 | -0.062 |
| J149 | 0.509 | -0.108 |
| J150 | 0.512 | -0.040 |
| J151 | 0.462 | 0.907 |
| J152 | 0.394 | 0.478 |
| J153 | 0.384 | 2.029 |
| J154 | 0.242 | 2.353 |
| J155 | 0.738 | 1.258 |
| J156 | 0.655 | 1.468 |

involved. The numbers of subjects in these three cases are 1,011 , 1,833 and 2,844 , respectively, as are shown in Table 3-2. In addition to these three cases, because of their larger sample sizes, J1/1075 and J1/2259 Cases were also analyzed alone, by assuming, separately, three-parameter logistic model as well as (two-parameter) logistic model. We shall call these four additional cases Case J1/1075: $c_g$-Zero, Case J1/1075: $c_g$-Free, Case J1/2259: $c_g$-Zero, and Case J1/2259: $c_g$-Free, respectively, depending upon whether the adopted model is two-parameter or three-parameter logistic model in each case.

Tables 7-1 and 7-2 present the estimated item discrimination parameter $\hat{a}_g$ and the estimated item difficulty parameters $\hat{b}_g$ of each item of Tests A5 and A6, respectively, which were obtained upon the Case A5-A6. In Logist 5, the resulting estimates of item parameters and individual parameters are adjusted to the scale of ability whose origin and unit are set equal to the mean and the standard deviation of the estimated individual parameters of the sample of subjects in question, excluding those which fall outside the interval, [-3, 3], after the last iteration. In Case A5-A6, one examinee was excluded because of his too low value of ability estimate, and seven examinees were excluded because of their too high values of ability estimate, to leave us 1,003 examinees in this process of standardization. Since the percentage of those examinees who were excluded is only 0.79 and negligibly small, hereafter, we shall treat the distribution of $\theta$ for the 1,003 examinees as if it were of the whole group of examinees. The same applies for Cases

## TABLE 7-1

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.800 | -1.717 |
| A502 | 0.557 | -2.729 |
| A503 | 0.636 | -2.873 |
| A504 | 0.668 | -1.462 |
| A505 | 0.842 | -1.809 |
| A506 | 0.500 | -1.444 |
| A507 | 0.533 | -0.306 |
| A508 | 0.823 | -1.238 |
| A509 | 1.533 | -1.352 |
| A510 | 0.688 | -0.293 |
| A511 | 0.518 | -1.575 |
| A512 | 0.738 | -1.321 |
| A513 | 1.102 | -2.196 |
| A514 | 0.963 | -1.268 |
| A515 | 0.512 | -1.700 |
| A516 | 0.456 | 1.216 |
| A517 | 1.896 | -1.742 |
| A518 | 0.400 | -1.903 |
| A519 | 0.753 | -1.361 |
| A520 | 0.391 | -2.574 |
| A521 | 0.687 | -1.331 |
| A522 | 0.436 | 0.020 |
| A523 | 0.089 ▲ | 5.596 ▲ |
| A524 | 0.469 | -1.454 |
| A525 | 1.075 | -1.397 |
| A526 | 0.944 | -0.175 |
| A527 | 0.094 ▲ | 0.290 |
| A528 | 0.457 | 0.607 |
| A529 | 0.574 | 0.108 |
| A530 | 0.673 | -1.134 |
| A531 | 0.031 ▲ | 41.264 ▲ |
| A532 | 0.548 | 0.747 |
| A533 | 0.848 | -1.208 |
| A534 | 0.877 | -1.568 |
| A535 | 0.678 | -0.694 |
| A536 | 0.711 | -0.484 |
| A537 | 0.515 | -0.723 |
| A538 | 1.263 | -0.313 |
| A539 | 0.761 | -0.371 |
| A540 | 0.453 | -0.016 |
| A541 | 0.564 | -0.237 |
| A542 | 0.479 | -0.829 |
| A543 | 0.520 | -0.477 |
| A544 | 0.861 | 0.196 |
| A545 | 0.953 | 0.017 |
| A546 | 0.344 | 1.077 |
| A547 | 0.307 | 0.297 |
| A548 | 0.506 | 0.591 |

**Note:** The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-2, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-2

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.848 | -1.208 |
| A602 | 0.877 | -1.568 |
| A603 | 0.678 | -0.694 |
| A604 | 0.711 | -0.484 |
| A605 | 0.515 | -0.723 |
| A606 | 1.263 | -0.313 |
| A607 | 0.761 | -0.371 |
| A608 | 0.453 | -0.016 |
| A609 | 0.564 | -0.237 |
| A610 | 0.479 | -0.829 |
| A611 | 0.520 | -0.477 |
| A612 | 0.861 | 0.196 |
| A613 | 0.953 | 0.017 |
| A614 | 0.344 | 1.077 |
| A615 | 0.307 | 0.297 |
| A616 | 0.506 | 0.591 |
| A617 | 0.995 | -0.923 |
| A618 | 0.510 | -0.532 |
| A619 | 0.603 | -0.517 |
| A620 | 0.912 | 0.118 |
| A621 | 0.881 | -0.264 |
| A622 | 0.628 | -1.018 |
| A623 | 0.459 | -0.818 |
| A624 | 0.608 | -1.541 |
| A625 | 0.408 | -1.190 |
| A626 | 0.522 | -0.337 |
| A627 | 0.337 | 0.276 |
| A628 | 0.242 | -2.154 |
| A629 | 0.653 | 0.088 |
| A630 | 0.638 | -0.330 |
| A631 | 0.593 | -0.140 |
| A632 | 0.645 | -0.779 |
| A633 | 0.399 | -0.491 |
| A634 | 1.183 | -0.996 |
| A635 | 0.946 | -1.538 |
| A636 | 0.718 | -0.973 |
| A637 | 0.483 | -0.433 |
| A638 | 0.455 | 1.587 |
| A639 | 0.056▲ | 13.295▲ |
| A640 | 0.536 | 0.600 |
| A641 | 0.628 | 0.907 |
| A642 | 0.658 | -0.618 |
| A643 | 0.731 | -0.162 |
| A644 | 1.147 | 0.280 |
| A645 | 0.487 | 0.481 |
| A646 | 0.497 | -0.070 |
| A647 | 0.536 | 1.185 |
| A648 | 0.873 | -1.088 |
| A649 | 0.440 | -0.070 |
| A650 | 0.546 | 0.390 |
| A651 | 0.617 | -0.263 |
| A652 | 0.273 | -0.381 |
| A653 | 0.544 | -0.043 |
| A654 | 0.243 | 3.015▲ |
| A655 | 0.857 | 0.301 |
| A656 | 0.499 | -0.736 |

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-1, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

J1-J2 and A5-A6-J1-J2, as we shall see later in this section.

It is interesting to note that the two items, A531 and A639, whose estimated item parameters by the Tetrachoric Method assume the most extreme values as are shown in Tables 5-1 and 5-2, are also the two items who have the most extreme sets of estimated item parameters in Tables 7-1 and 7-2. For convenience, the estimated item discrimination parameters which is less than 0.100 and the estimated item difficulty parameters which exceed 3.000 are marked with ▲ in these tables, and also in Tables 7-3 through 7-9 and in Table 7-11, which will be presented later in this Section. These marks reveal a strong consistency in extreme parameter estimates between the results of the Tetrachoric Method and those of Logist 5 . We notice, moreover, that the whole configurations of the estimated discrimination parameters and of the estimated diffuculty parameters are very similar to those obtained by the Tetrachoric Method.

The corresponding results of Tests J1 and J2 obtained upon the Case J1-J2 are shown in Tables 7-3 and 7-4, respectively. In this case, those who were excluded in the process of standardization because of their too low and too high values of ability estimate number one and twelve, respectively, to make the number of remaining examinees 1,820. It is noted, again, that the percentage of those who were excluded is negligibly small, i.e., 0.71 .

We can see in these two tables that item J138 in Table 7-3 and item J202 in Table 7-4 are the only marked items, whose estimated discrimination parameters are less than 0.100 and whose estimated

# TABLE 7-3

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.970 | -0.617 |
| J102 | 0.642 | -1.215 |
| J103 | 0.867 | -1.316 |
| J104 | 0.903 | -1.266 |
| J105 | 0.951 | -0.752 |
| J106 | 0.611 | -1.111 |
| J107 | 0.630 | -0.617 |
| J108 | 1.381 | -1.862 |
| J109 | 0.406 | -1.387 |
| J110 | 0.784 | -0.956 |
| J111 | 1.527 | -1.482 |
| J112 | 0.577 | -1.119 |
| J113 | 0.708 | -1.322 |
| J114 | 0.773 | -0.442 |
| J115 | 1.021 | -0.748 |
| J116 | 0.448 | -1.372 |
| J117 | 0.423 | -0.979 |
| J118 | 0.734 | -1.354 |
| J119 | 0.777 | -1.311 |
| J120 | 0.388 | 0.387 |
| J121 | 0.619 | -1.145 |
| J122 | 0.648 | -1.202 |
| J123 | 0.609 | -0.399 |
| J124 | 0.820 | -1.738 |
| J125 | 0.677 | -1.743 |
| J126 | 0.580 | -1.004 |
| J127 | 0.748 | -1.674 |
| J128 | 1.063 | -1.256 |
| J129 | 0.843 | 0.685 |
| J130 | 0.463 | -1.839 |
| J131 | 1.095 | -0.827 |
| J132 | 0.517 | -0.554 |
| J133 | 1.070 | -1.724 |
| J134 | 0.383 | 1.076 |
| J135 | 1.025 | -0.667 |
| J136 | 0.415 | -0.317 |
| J137 | 0.796 | -0.579 |
| J138 | 0.010▲ | 145.324▲ |
| J139 | 0.495 | 0.643 |
| J140 | 0.417 | -0.347 |
| J141 | 0.687 | -1.267 |
| J142 | 0.606 | -0.292 |
| J143 | 0.858 | -0.728 |
| J144 | 0.496 | -1.016 |
| J145 | 0.863 | -0.679 |
| J146 | 0.983 | -0.721 |
| J147 | 0.664 | -0.382 |
| J148 | 0.707 | -0.352 |
| J149 | 0.599 | -0.672 |
| J150 | 0.588 | -0.553 |
| J151 | 0.719 | 0.120 |
| J152 | 0.553 | -0.156 |
| J153 | 0.536 | 0.696 |
| J154 | 0.473 | 0.458 |
| J155 | 1.103 | 0.209 |
| J156 | 1.025 | 0.552 |

Note: The estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-4, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

## TABLE 7-4

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.796 | -0.579 |
| J202 | 0.010▲ | 145.324▲ |
| J203 | 0.495 | 0.643 |
| J204 | 0.417 | -0.347 |
| J205 | 0.687 | -1.267 |
| J206 | 0.606 | -0.292 |
| J207 | 0.858 | -0.728 |
| J208 | 0.496 | -1.016 |
| J209 | 0.863 | -0.679 |
| J210 | 0.983 | -0.721 |
| J211 | 0.664 | -0.382 |
| J212 | 0.707 | -0.352 |
| J213 | 0.599 | -0.672 |
| J214 | 0.588 | -0.553 |
| J215 | 0.719 | 0.120 |
| J216 | 0.553 | -0.156 |
| J217 | 0.536 | 0.696 |
| J218 | 0.473 | 0.458 |
| J219 | 1.103 | 0.209 |
| J220 | 1.025 | 0.552 |
| J221 | 0.466 | 0.805 |
| J222 | 0.764 | -0.143 |
| J223 | 0.506 | -0.922 |
| J224 | 0.747 | -0.153 |
| J225 | 0.810 | -0.617 |
| J226 | 0.727 | -0.131 |
| J227 | 0.731 | -0.442 |
| J228 | 0.791 | -0.742 |
| J229 | 0.756 | -0.493 |
| J230 | 0.665 | -0.480 |
| J231 | 1.701 | -0.592 |
| J232 | 1.089 | -0.689 |
| J233 | 0.332 | 1.041 |
| J234 | 0.385 | 0.506 |
| J235 | 1.110 | -0.127 |
| J236 | 1.012 | -0.035 |
| J237 | 0.294 | -0.634 |
| J238 | 0.858 | 1.215 |
| J239 | 0.550 | 0.278 |
| J240 | 0.673 | 0.732 |
| J241 | 1.300 | -0.592 |
| J242 | 0.878 | -0.389 |
| J243 | 0.428 | -0.249 |
| J244 | 0.315 | 0.146 |
| J245 | 0.892 | 0.342 |
| J246 | 0.285 | 0.611 |
| J247 | 0.546 | 0.271 |
| J248 | 0.435 | -1.121 |
| J249 | 0.747 | 0.182 |
| J250 | 0.765 | 0.102 |
| J251 | 1.046 | -0.399 |
| J252 | 0.561 | 0.430 |
| J253 | 0.617 | 0.482 |
| J254 | 0.615 | 0.445 |
| J255 | 1.179 | 0.505 |
| J256 | 0.548 | 0.975 |
| J257 | 0.573 | 0.190 |
| J258 | 0.442 | 0.585 |
| J259 | 0.843 | 0.659 |
| J260 | 0.126 | 1.664 |

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-3, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

difficulty parameters are greater than 3.000 . As we can see in the notes attached to these two tables, they are a single item overlapping in Test J1 and J2, and also it is the item which has been discarded by Shiba (cf. Tables 5-3 and 5-4). Again we notice that the whole configurations of the two estimated item parameters in Tables 7-3 and 7-4 are very similar to those obtained by the Tetrachoric Method, which are shown in Tables 5-3 and 5-4, respectively.

Tables 7-5 through 7-8 present the resulting item parameter estimates of each item of Tests A5, A6, J1 and J2, respectively, which were obtained upon the Case A5-A6-J1-J2. Again, some subjects were excluded in the process of standardization, and those who were excluded because of thier too low ability estimates and of their too high ones number one and thirteen, respectively. Thus we had 2,830 subjects in the standardization process of this case. The percentage of those examinees who were excluded is, again, negligibly small, i.e., 0.49 .

It is noted that, in general, the estimated discrimination parameters of the items of Tests A5 and A6 in Tables 7-5 and 7-6 are larger than the corresponding values shown in Tables 7-1 and 7-2, even in the extreme cases such as items A531, A639, A523 and A527. This is an expected result, for the distribution of the individual ability estimates in Case A5-A6-J1-J2 is likely to have a larger standard deviation than the one in Case A5-A6, and, therefore, the scale unit in Case A5-A6-J1-J2 is larger than that in Case A5-A6. The true comparison of these two sets of results will be possible after a

## TABLE 7-5

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 1.017 | -2.059 |
| A502 | 0.708 | -2.858 |
| A503 | 0.808 | -2.969 |
| A504 | 0.852 | -1.857 |
| A505 | 1.077 | -2.127 |
| A506 | 0.636 | -1.845 |
| A507 | 0.679 | -0.950 |
| A508 | 1.049 | -1.681 |
| A509 | 1.951 | -1.772 |
| A510 | 0.877 | -0.940 |
| A511 | 0.659 | -1.948 |
| A512 | 0.939 | -1.748 |
| A513 | 1.404 | -2.434 |
| A514 | 1.226 | -1.706 |
| A515 | 0.651 | -2.046 |
| A516 | 0.580 | 0.246 |
| A517 | 2.405 | -2.080 |
| A518 | 0.510 | -2.205 |
| A519 | 0.961 | -1.777 |
| A520 | 0.498 | -2.733 |
| A521 | 0.874 | -1.755 |
| A522 | 0.555 | -0.694 |
| A523 | 0.112 | 3.754▲ |
| A524 | 0.596 | -1.853 |
| A525 | 1.371 | -1.806 |
| A526 | 1.200 | -0.847 |
| A527 | 0.122 | -0.488 |
| A528 | 0.580 | -0.232 |
| A529 | 0.730 | -0.625 |
| A530 | 0.853 | -1.603 |
| A531 | 0.036▲ | 34.662▲ |
| A532 | 0.697 | -0.123 |
| A533 | 1.095 | -1.649 |
| A534 | 1.133 | -1.927 |
| A535 | 0.877 | -1.250 |
| A536 | 0.926 | -1.087 |
| A537 | 0.668 | -1.273 |
| A538 | 1.631 | -0.955 |
| A539 | 0.985 | -1.001 |
| A540 | 0.590 | -0.728 |
| A541 | 0.737 | -0.897 |
| A542 | 0.624 | -1.353 |
| A543 | 0.679 | -1.082 |
| A544 | 1.117 | -0.563 |
| A545 | 1.236 | -0.701 |
| A546 | 0.446 | 0.114 |
| A547 | 0.400 | -0.489 |
| A548 | 0.660 | -0.263 |

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-6, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2.

## TABLE 7-6

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 1.095 | -1.649 |
| A602 | 1.133 | -1.927 |
| A603 | 0.877 | -1.250 |
| A604 | 0.926 | -1.087 |
| A605 | 0.668 | -1.273 |
| A606 | 1.631 | -0.955 |
| A607 | 0.985 | -1.001 |
| A608 | 0.590 | -0.728 |
| A609 | 0.737 | -0.897 |
| A610 | 0.624 | -1.353 |
| A611 | 0.679 | -1.082 |
| A612 | 1.117 | -0.563 |
| A613 | 1.236 | -0.701 |
| A614 | 0.446 | 0.114 |
| A615 | 0.400 | -0.489 |
| A616 | 0.660 | -0.263 |
| A617 | 1.330 | -1.405 |
| A618 | 0.672 | -1.120 |
| A619 | 0.808 | -1.100 |
| A620 | 1.236 | -0.625 |
| A621 | 1.161 | -0.914 |
| A622 | 0.833 | -1.481 |
| A623 | 0.610 | -1.330 |
| A624 | 0.811 | -1.870 |
| A625 | 0.544 | -1.607 |
| A626 | 0.697 | -0.967 |
| A627 | 0.452 | -0.508 |
| A628 | 0.323 | -2.327 |
| A629 | 0.860 | -0.650 |
| A630 | 0.854 | -0.960 |
| A631 | 0.792 | -0.819 |
| A632 | 0.862 | -1.297 |
| A633 | 0.533 | -1.082 |
| A634 | 1.568 | -1.462 |
| A635 | 1.264 | -1.865 |
| A636 | 0.955 | -1.446 |
| A637 | 0.644 | -1.039 |
| A638 | 0.611 | 0.468 |
| A639 | 0.079▲ | 8.694▲ |
| A640 | 0.709 | -0.264 |
| A641 | 1.032 | -0.140 |
| A642 | 0.659 | -0.911 |
| A643 | 0.968 | -0.796 |
| A644 | 1.199 | -0.610 |
| A645 | 0.910 | -0.325 |
| A646 | 0.659 | -0.658 |
| A647 | 0.754 | -0.066 |
| A648 | 1.346 | -1.391 |
| A649 | 0.495 | -0.788 |
| A650 | 0.842 | -0.457 |
| A651 | 1.343 | -0.948 |
| A652 | 0.541 | -0.741 |
| A653 | 0.790 | -0.767 |
| A654 | 0.753 | 0.132 |
| A655 | 1.093 | -0.336 |
| A656 | 0.475 | -1.055 |

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-5, respectively since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2. Also The estimated item parameters for items A641 through A656 are the same as those for J101 through J116 in Table 7-7, respectively, since they are overlapping items between Tests A6 and J1.

## TABLE 7-7

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 1.032 | -0.140 |
| J102 | 0.659 | -0.911 |
| J103 | 0.968 | -0.796 |
| J104 | 1.199 | -0.610 |
| J105 | 0.910 | -0.325 |
| J106 | 0.659 | -0.658 |
| J107 | 0.754 | -0.066 |
| J108 | 1.346 | -1.391 |
| J109 | 0.495 | -0.788 |
| J110 | 0.842 | -0.457 |
| J111 | 1.343 | -0.948 |
| J112 | 0.541 | -0.741 |
| J113 | 0.790 | -0.767 |
| J114 | 0.753 | 0.132 |
| J115 | 1.093 | -0.336 |
| J116 | 0.475 | -1.055 |
| J117 | 0.478 | -0.472 |
| J118 | 0.830 | -0.804 |
| J119 | 0.880 | -0.764 |
| J120 | 0.437 | 0.738 |
| J121 | 0.701 | -0.618 |
| J122 | 0.731 | -0.670 |
| J123 | 0.692 | 0.041 |
| J124 | 0.928 | -1.143 |
| J125 | 0.768 | -1.146 |
| J126 | 0.656 | -0.494 |
| J127 | 0.848 | -1.085 |
| J128 | 1.200 | -0.718 |
| J129 | 0.956 | 0.999 |
| J130 | 0.522 | -1.235 |
| J131 | 1.237 | -0.337 |
| J132 | 0.584 | -0.096 |
| J133 | 1.204 | -1.135 |
| J134 | 0.433 | 1.344 |
| J135 | 1.161 | -0.196 |
| J136 | 0.469 | 0.114 |
| J137 | 0.902 | -0.119 |
| J138 | 0.010▲ | 145.711▲ |
| J139 | 0.562 | 0.958 |
| J140 | 0.472 | 0.085 |
| J141 | 0.779 | -0.725 |
| J142 | 0.687 | 0.134 |
| J143 | 0.973 | -0.250 |
| J144 | 0.563 | -0.504 |
| J145 | 0.979 | -0.206 |
| J146 | 1.118 | -0.242 |
| J147 | 0.753 | 0.055 |
| J148 | 0.802 | 0.082 |
| J149 | 0.682 | -0.200 |
| J150 | 0.667 | -0.096 |
| J151 | 0.816 | 0.498 |
| J152 | 0.628 | 0.255 |
| J153 | 0.609 | 1.004 |
| J154 | 0.536 | 0.795 |
| J155 | 1.254 | 0.576 |
| J156 | 1.167 | 0.877 |

Note: The estimated item parameters for items J101 through J116 are the same as those for items A641 through A656 in Table 7-6, respectively, since they are overlapping items between Tests A6 and J1 and the results are of Case A5-A6-J1-J2. Also the estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-8, respectively, since they are overlapping items between Tests J1 and J2.

## TABLE 7-8

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.902 | -0.119 |
| J202 | 0.010▲ | 145.711▲ |
| J203 | 0.562 | 0.958 |
| J204 | 0.472 | 0.085 |
| J205 | 0.779 | -0.725 |
| J206 | 0.687 | 0.134 |
| J207 | 0.973 | -0.250 |
| J208 | 0.563 | -0.504 |
| J209 | 0.979 | -0.206 |
| J210 | 1.118 | -0.242 |
| J211 | 0.753 | 0.055 |
| J212 | 0.802 | 0.082 |
| J213 | 0.682 | -0.200 |
| J214 | 0.667 | -0.096 |
| J215 | 0.816 | 0.498 |
| J216 | 0.628 | 0.255 |
| J217 | 0.609 | 1.004 |
| J218 | 0.536 | 0.795 |
| J219 | 1.254 | 0.576 |
| J220 | 1.167 | 0.877 |
| J221 | 0.531 | 1.097 |
| J222 | 0.870 | 0.265 |
| J223 | 0.578 | -0.418 |
| J224 | 0.851 | 0.256 |
| J225 | 0.925 | -0.149 |
| J226 | 0.831 | 0.276 |
| J227 | 0.833 | 0.003 |
| J228 | 0.902 | -0.260 |
| J229 | 0.863 | -0.042 |
| J230 | 0.757 | -0.031 |
| J231 | 1.938 | -0.129 |
| J232 | 1.242 | -0.213 |
| J233 | 0.380 | 1.303 |
| J234 | 0.440 | 0.834 |
| J235 | 1.268 | 0.279 |
| J236 | 1.153 | 0.360 |
| J237 | 0.336 | -0.163 |
| J238 | 0.977 | 1.457 |
| J239 | 0.626 | 0.634 |
| J240 | 0.767 | 1.033 |
| J241 | 1.487 | -0.128 |
| J242 | 1.001 | 0.049 |
| J243 | 0.487 | 0.171 |
| J244 | 0.358 | 0.518 |
| J245 | 1.016 | 0.690 |
| J246 | 0.324 | 0.927 |
| J247 | 0.623 | 0.629 |
| J248 | 0.496 | -0.593 |
| J249 | 0.849 | 0.550 |
| J250 | 0.872 | 0.480 |
| J251 | 1.194 | 0.041 |
| J252 | 0.640 | 0.767 |
| J253 | 0.703 | 0.814 |
| J254 | 0.702 | 0.781 |
| J255 | 1.341 | 0.834 |
| J256 | 0.624 | 1.246 |
| J257 | 0.653 | 0.557 |
| J258 | 0.504 | 0.904 |
| J259 | 0.960 | 0.969 |
| J260 | 0.142 | 1.863 |

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-7, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case A5-A6-J1-J2.

suitable scale adjustment, which is to be done later. We also notice that there are more negative values in the estimated difficulty parameters in Tables 7-5 and 7-6 than in those in Tables 7-1 and 7-2. Again this is an expected result, for the mean of the distribution of the individual ability estimates in Case A5-A6-J1-J2 is likely to be higher than that in Case A5-A6, and, therefore, the origin of the scale in the former is shifted to the positive direction.

Comparison of the results in Tables 7-7 and 7-8 with those in Tables 7-3 and 7-4 reveals the same tendency for the estimated discrimination parameters of the items of Tests J1 and J2 as we observed for the items of Tests A5 and A6, and also the reversed tendency for the estimated difficulty parameters. Again they are no surprise, for the origin of the scale used for Case A5-A6-J1-J2 is expected to be shifted to the negative direction compared with that in Case J1-J2, and the unit is expected to be larger in the former case than in the latter.

The estimated item parameters of each item of Test J1 which were obtained upon the Cases J1/1075: $c_g$-Zero and J1/1075: $c_g$-Free are presented in Tables 7-9 and 7-10, respectively. Since in the latter three-parameter logistic model is assumed, there is an additional column of the estimated guessing parameter $c_g$ in Table 7-10. The corresponding sets of results for Cases J1/2259: $c_g$-Zero and J1/2259: $c_g$-Free are shown in Tables 7-11 and 7-12, respectively. In these cases, item J138 is excluded, since it was discarded in Shiba's research and also it provided us with meaningless

TABLE 7-9

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.842 | -0.309 |
| J102 | 0.560 | -0.994 |
| J103 | 0.757 | -1.110 |
| J104 | 0.788 | -1.052 |
| J105 | 0.832 | -0.463 |
| J106 | 0.535 | -0.873 |
| J107 | 0.550 | -0.307 |
| J108 | 1.214 | -1.729 |
| J109 | 0.356 | -1.184 |
| J110 | 0.691 | -0.693 |
| J111 | 1.338 | -1.298 |
| J112 | 0.501 | -0.886 |
| J113 | 0.615 | -1.120 |
| J114 | 0.674 | -0.107 |
| J115 | 0.895 | -0.458 |
| J116 | 0.388 | -1.178 |
| J117 | 0.369 | -0.723 |
| J118 | 0.637 | -1.157 |
| J119 | 0.676 | -1.105 |
| J120 | 0.338 | 0.846 |
| J121 | 0.543 | -0.911 |
| J122 | 0.566 | -0.978 |
| J123 | 0.531 | -0.058 |
| J124 | 0.717 | -1.591 |
| J125 | 0.594 | -1.593 |
| J126 | 0.507 | -0.751 |
| J127 | 0.652 | -1.520 |
| J128 | 0.930 | -1.040 |
| J129 | 0.734 | 1.188 |
| J130 | 0.406 | -1.702 |
| J131 | 0.957 | -0.549 |
| J132 | 0.448 | -0.236 |
| J133 | 0.945 | -1.567 |
| J134 | 0.330 | 1.651 |
| J135 | 0.898 | -0.366 |
| J136 | 0.362 | 0.037 |
| J137 | 0.695 | -0.173 |
| J138 | --- | --- |
| J139 | 0.456 | 0.945 |
| J140 | 0.420 | -0.012 |
| J141 | 0.645 | -1.025 |
| J142 | 0.506 | 0.106 |
| J143 | 0.749 | -0.430 |
| J144 | 0.397 | -0.693 |
| J145 | 0.822 | -0.504 |
| J146 | 0.915 | -0.325 |
| J147 | 0.499 | -0.013 |
| J148 | 0.536 | 0.112 |
| J149 | 0.538 | -0.436 |
| J150 | 0.532 | -0.333 |
| J151 | 0.493 | 0.611 |
| J152 | 0.390 | 0.298 |
| J153 | 0.503 | 1.092 |
| J154 | 0.248 | 1.613 |
| J155 | 0.921 | 0.695 |
| J156 | 0.788 | 1.047 |

## TABLE 7-10

**Estimated Item Discrimination Parameter $\hat{a}_g$, Item Difficulty Parameter $\hat{b}_g$ And Guessing Parameter $c_g$ of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ | $\hat{c}_g$ |
|---|---|---|---|
| J101 | 1.104 | 0.006 | 0.146 |
| J102 | 0.588 | -0.706 | 0.143 |
| J103 | 0.786 | -0.872 | 0.143 |
| J104 | 0.854 | -0.795 | 0.143 |
| J105 | 1.034 | -0.167 | 0.137 |
| J106 | 0.599 | -0.512 | 0.143 |
| J107 | 0.678 | 0.054 | 0.143 |
| J108 | 1.012 | -1.855 | 0.143 |
| J109 | 0.382 | -0.726 | 0.143 |
| J110 | 0.781 | -0.382 | 0.143 |
| J111 | 1.286 | -1.201 | 0.143 |
| J112 | 0.538 | -0.541 | 0.143 |
| J113 | 0.634 | -0.857 | 0.143 |
| J114 | 1.285 | 0.411 | 0.234 |
| J115 | 1.185 | -0.100 | 0.173 |
| J116 | 0.421 | -0.753 | 0.143 |
| J117 | 0.411 | -0.245 | 0.143 |
| J118 | 0.640 | -0.916 | 0.143 |
| J119 | 0.707 | -0.851 | 0.143 |
| J120 | 1.205 | 1.310 | 0.278 |
| J121 | 0.584 | -0.580 | 0.143 |
| J122 | 0.601 | -0.665 | 0.143 |
| J123 | 0.697 | 0.311 | 0.143 |
| J124 | 0.679 | -1.479 | 0.143 |
| J125 | 0.584 | -1.415 | 0.143 |
| J126 | 0.568 | -0.375 | 0.143 |
| J127 | 0.635 | -1.364 | 0.143 |
| J128 | 0.964 | -0.831 | 0.143 |
| J129 | 0.900 | 1.110 | 0.018 |
| J130 | 0.403 | -1.402 | 0.143 |
| J131 | 1.327 | -0.167 | 0.191 |
| J132 | 0.555 | 0.193 | 0.143 |
| J133 | 0.909 | -1.471 | 0.143 |
| J134 | 0.702 | 1.715 | 0.162 |
| J135 | 0.922 | -0.266 | 0.041 |
| J136 | 0.453 | 0.515 | 0.143 |
| J137 | 0.897 | 0.130 | 0.131 |
| J138 | --- | --- | --- |
| J139 | 1.335 | 1.197 | 0.213 |
| J140 | 0.660 | 0.623 | 0.218 |
| J141 | 0.667 | -0.762 | 0.143 |
| J142 | 1.024 | 0.687 | 0.245 |
| J143 | 1.102 | 0.018 | 0.201 |
| J144 | 0.451 | -0.238 | 0.143 |
| J145 | 0.903 | -0.287 | 0.103 |
| J146 | 1.053 | -0.130 | 0.087 |
| J147 | 1.727 | 0.779 | 0.338 |
| J148 | 0.895 | 0.613 | 0.207 |
| J149 | 0.639 | -0.063 | 0.143 |
| J150 | 0.629 | 0.041 | 0.143 |
| J151 | 0.889 | 0.980 | 0.181 |
| J152 | 1.391 | 1.086 | 0.331 |
| J153 | 1.250 | 1.212 | 0.167 |
| J154 | 0.764 | 1.895 | 0.249 |
| J155 | 1.768 | 0.771 | 0.089 |
| J156 | 1.592 | 1.030 | 0.086 |

## TABLE 7-11

**Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.771 | -0.509 |
| J102 | 0.554 | -1.192 |
| J103 | 0.627 | -1.428 |
| J104 | 0.775 | -1.034 |
| J105 | 0.855 | -0.377 |
| J106 | 0.517 | -0.972 |
| J107 | 0.594 | -0.083 |
| J108 | 0.987 | -1.986 |
| J109 | 0.389 | -1.109 |
| J110 | 0.596 | -0.592 |
| J111 | 1.165 | -1.422 |
| J112 | 0.442 | -1.283 |
| J113 | 0.532 | -1.287 |
| J114 | 0.492 | 0.175 |
| J115 | 0.752 | -0.502 |
| J116 | 0.305 | -1.876 |
| J117 | 0.400 | -0.861 |
| J118 | 0.665 | -1.693 |
| J119 | 0.710 | -1.189 |
| J120 | 0.296 | 0.715 |
| J121 | 0.506 | -1.096 |
| J122 | 0.476 | -1.245 |
| J123 | 0.465 | -0.144 |
| J124 | 0.626 | -1.465 |
| J125 | 0.493 | -1.807 |
| J126 | 0.378 | -0.664 |
| J127 | 0.579 | -1.462 |
| J128 | 0.763 | -1.285 |
| J129 | 0.763 | 1.130 |
| J130 | 0.392 | -1.883 |
| J131 | 0.869 | -0.753 |
| J132 | 0.335 | -0.108 |
| J133 | 0.968 | -1.526 |
| J134 | 0.301 | 1.275 |
| J135 | 0.925 | -0.502 |
| J136 | 0.366 | -0.015 |
| J137 | 0.611 | 0.025 |
| J138 | --- | --- |
| J139 | 0.401 | 1.179 |
| J140 | 0.419 | -0.075 |
| J141 | 0.588 | -0.945 |
| J142 | 0.467 | -0.157 |
| J143 | 0.622 | -0.379 |
| J144 | 0.380 | -0.685 |
| J145 | 0.656 | -0.752 |
| J146 | 0.936 | -0.243 |
| J147 | 0.366 | 0.068 |
| J148 | 0.525 | -0.355 |
| J149 | 0.505 | -0.393 |
| J150 | 0.542 | -0.324 |
| J151 | 0.474 | 0.558 |
| J152 | 0.403 | 0.151 |
| J153 | 0.436 | 1.525 |
| J154 | 0.257 | 1.822 |
| J155 | 0.799 | 0.916 |
| J156 | 0.744 | 1.077 |

## TABLE 7-12

**Estimated Item Discrimination Parameter $\hat{a}_g$, Item Difficulty Parameter $\hat{b}_g$ And Guessing Parameter $c_g$ of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ | $\hat{c}_g$ |
|---|---|---|---|
| J101 | 0.957 | -0.195 | 0.151 |
| J102 | 0.576 | -0.924 | 0.146 |
| J103 | 0.644 | -1.198 | 0.146 |
| J104 | 0.849 | -0.781 | 0.146 |
| J105 | 1.034 | -0.154 | 0.109 |
| J106 | 0.570 | -0.627 | 0.146 |
| J107 | 0.733 | 0.170 | 0.109 |
| J108 | 0.857 | -2.097 | 0.146 |
| J109 | 0.424 | -0.682 | 0.146 |
| J110 | 0.712 | -0.240 | 0.146 |
| J111 | 1.123 | -1.342 | 0.146 |
| J112 | 0.461 | -0.946 | 0.146 |
| J113 | 0.556 | -0.998 | 0.146 |
| J114 | 1.004 | 0.743 | 0.245 |
| J115 | 0.955 | -0.140 | 0.172 |
| J116 | 0.324 | -1.385 | 0.146 |
| J117 | 0.444 | -0.426 | 0.146 |
| J118 | 0.635 | -1.581 | 0.146 |
| J119 | 0.749 | -0.948 | 0.146 |
| J120 | 0.571 | 1.361 | 0.229 |
| J121 | 0.535 | -0.777 | 0.146 |
| J122 | 0.497 | -0.923 | 0.146 |
| J123 | 0.582 | 0.257 | 0.146 |
| J124 | 0.625 | -1.261 | 0.146 |
| J125 | 0.491 | -1.588 | 0.146 |
| J126 | 0.433 | -0.190 | 0.146 |
| J127 | 0.580 | -1.252 | 0.146 |
| J128 | 0.772 | -1.103 | 0.146 |
| J129 | 0.884 | 1.063 | 0.013 |
| J130 | 0.388 | -1.597 | 0.146 |
| J131 | 1.063 | -0.418 | 0.178 |
| J132 | 0.413 | 0.415 | 0.146 |
| J133 | 0.968 | -1.401 | 0.146 |
| J134 | 0.460 | 1.620 | 0.146 |
| J135 | 1.011 | -0.342 | 0.085 |
| J136 | 0.460 | 0.459 | 0.146 |
| J137 | 0.769 | 0.269 | 0.108 |
| J138 | --- | --- | --- |
| J139 | 1.005 | 1.355 | 0.193 |
| J140 | 0.531 | 0.358 | 0.146 |
| J141 | 0.628 | -0.646 | 0.146 |
| J142 | 0.854 | 0.557 | 0.267 |
| J143 | 0.915 | 0.114 | 0.209 |
| J144 | 0.426 | -0.226 | 0.146 |
| J145 | 0.727 | -0.455 | 0.146 |
| J146 | 1.154 | -0.041 | 0.101 |
| J147 | 1.571 | 1.025 | 0.373 |
| J148 | 0.638 | 0.022 | 0.146 |
| J149 | 0.600 | -0.015 | 0.146 |
| J150 | 0.660 | 0.043 | 0.146 |
| J151 | 0.817 | 0.944 | 0.182 |
| J152 | 1.026 | 0.949 | 0.308 |
| J153 | 1.323 | 1.375 | 0.156 |
| J154 | 0.677 | 1.945 | 0.212 |
| J155 | 1.505 | 0.920 | 0.085 |
| J156 | 1.589 | 1.043 | 0.095 |

item parameter estimates in Cases J1-J2 and A5-A6-J1-J2, as was observed earlier in this section.

Observation of Tables 7-9 and 7-11 reveals that the estimated item discrimination parameters obtained by Logist 5 in Cases J1/1075: $c_g$-Zero and J1/2259: $c_g$-Zero tend to be greater than their counterparts obtained by the Tetrachoric Method, which are shown in Tables 5-11 and 5-12, respectively, while the estimated item difficulty parameters by Logist 5 in these two cases tend to be larger in absolute value. This fact indicates that the standard deviation of the estimated individual parameters may be larger than that of $\theta$ itself for the J1/1075 and J1/2259 Cases.

Comparison of Table 7-10 with Table 7-9, and of Table 7-12 with Table 7-11, reveals that the estimated discrimination parameters when three-parameter logistic model is assumed are, in general, larger than those when (two-parameter) logistic model is assumed, and the same is true with the estimated difficulty parameters. This is especially true when the estimated guessing parameter assumes a large value in Cases J1/1075: $c_g$-Free and J1/2259: $c_g$-Free, as we can see in items J114, J120, J139, J140, J142, J143, J147, J148, J152 and J154 in Case J1/1075, and in items J114, J120, J142, J143, J147, J152 and J154 in Case J1/2259. It is also noted that, except for these items, all the other items have estimated guessing parameters which are less than the chance level, i.e., 0.2 .

Enhancement of both the estimated discrimination and the estimated difficulty parameters when three-parameter logistic model is assumed appeared to have a good reason. This topic has been more systematically investigated, and discussed in a separate paper (Samejima, ONR/RR-84-3). As a conclusion, the meaning of discrimination and difficulty parameters must seriously be reconsidered in the three-parameter logistic model.

Figure 7-1 presents five scatter diagrams, in which the estimated item discrimination parameters of the items of Test A5, A6, J1 or J2 obtained by Logist 5 in Case A5-A6 or in Case J1-J2 are plotted against those obtained by the Tetrachoric Method. In the third graph, the diagram consists of only sixteen items which overlap Tests A6 and J1, while in the other four it consists of all the items in each of the four tests except for those whose estimates are extremely deviated. The corresponding five graphs for the estimated difficulty parameters are shown in Figure 7-2. We can see in these two figures that there is a substantial consistency in the estimated item parameters obtained by Logist 5 based upon two examinee groups, i.e., Case A5-A6 or Case J1-J2, and those obtained by the Tetrachoric Method.

Figures 7-3 and 7-4 present similar graphs as those of Figures 7-1 and 7-2 excluding the third graph of sixteen items, using the results of Case A5-A6-J1-J2 instead of those of Case A5-A6 or Case J1-J2. We can see that, again, there exists a substantial consistency in each pair of estimated item parameters.

Figures 7-5 shows eight scatter diagrams of the estimated item discrimination parameters of Test J1. They consist of four pairs, in

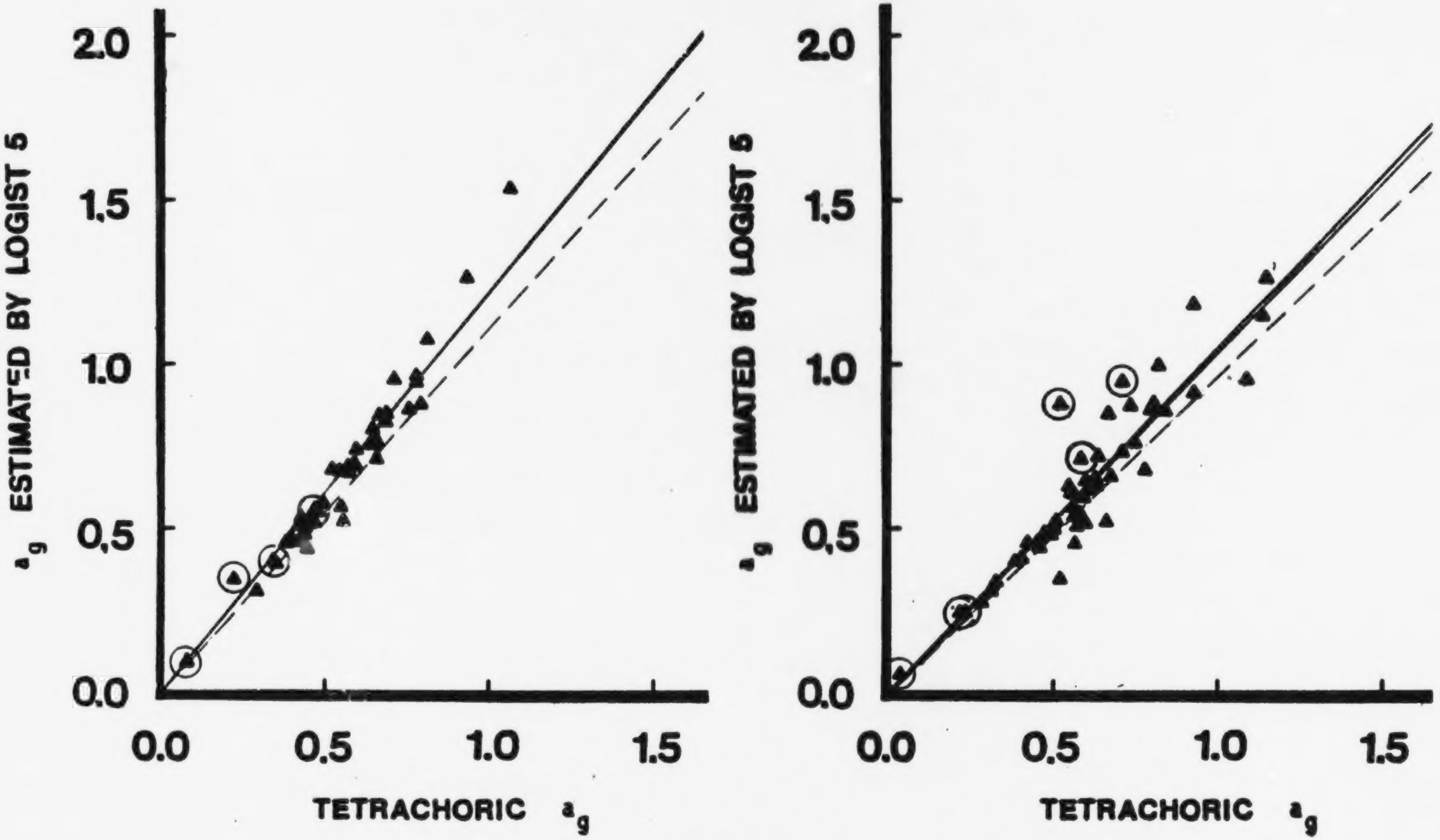

FIGURE 7-1

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa and upon the Case A5-A6 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

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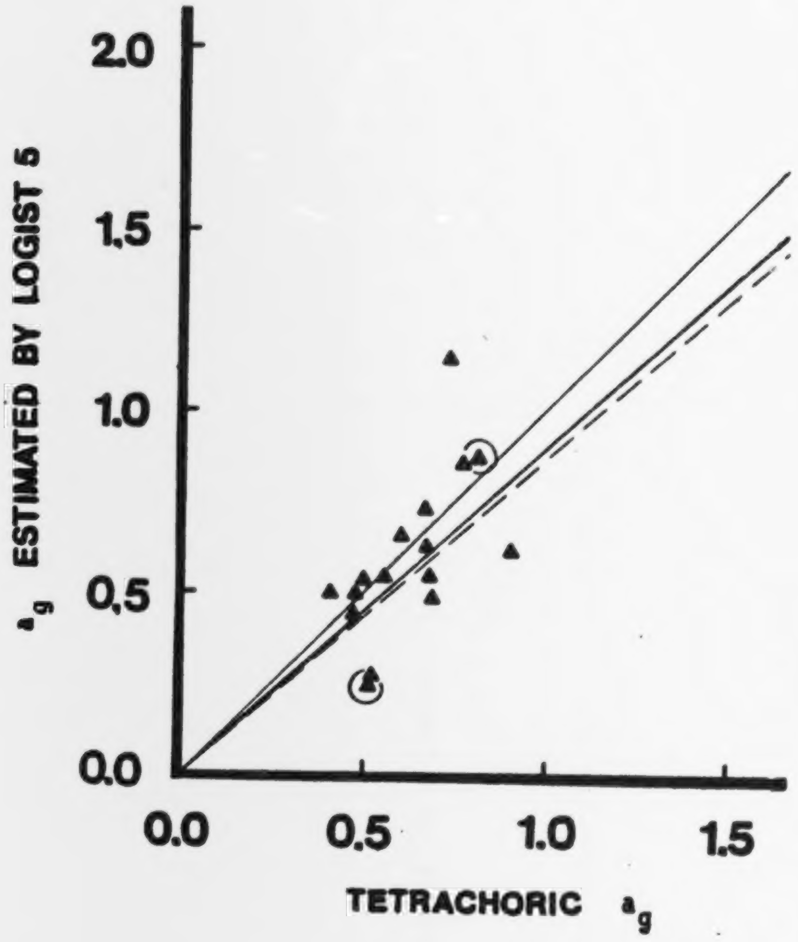

FIGURE 7-1 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

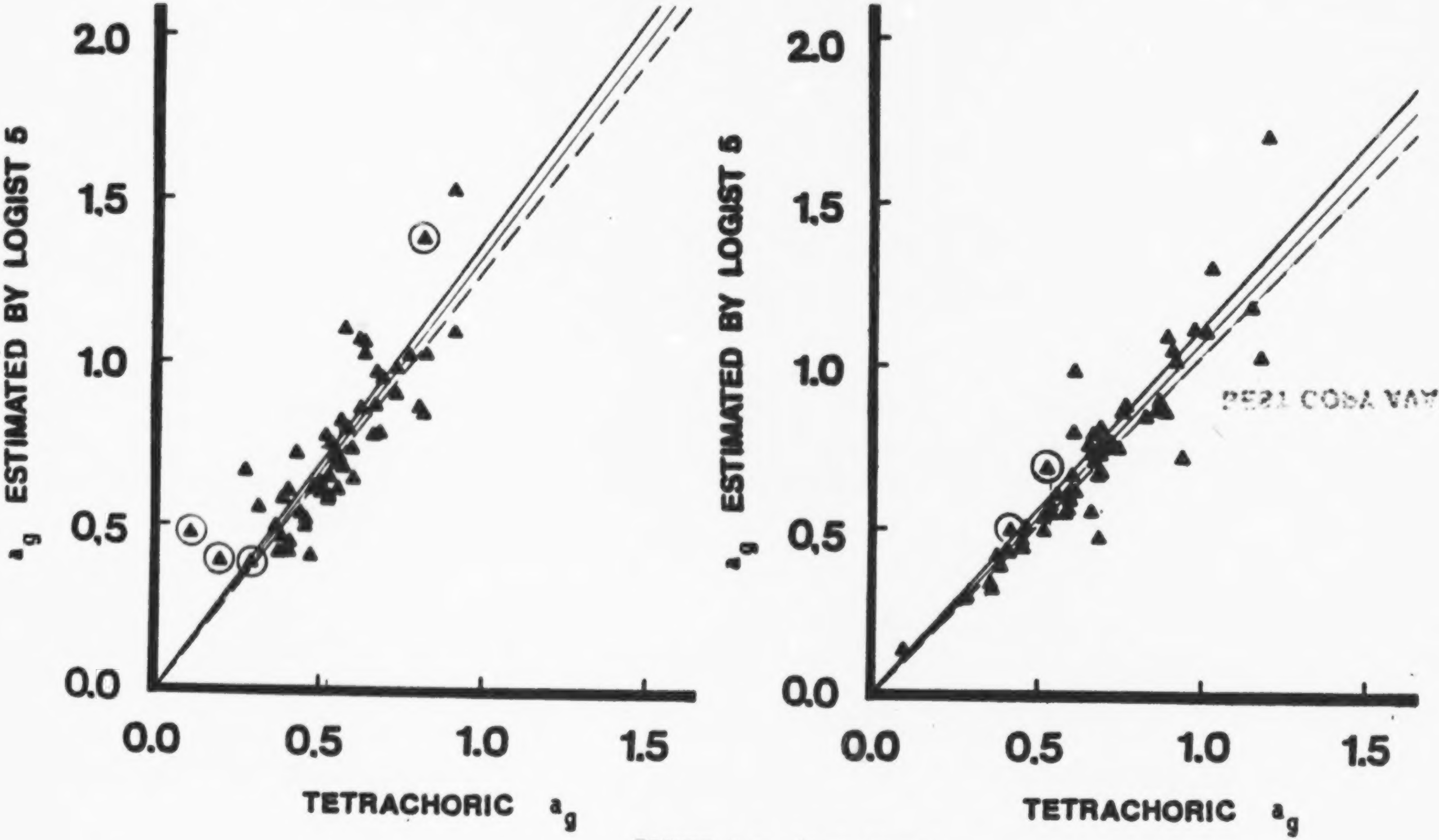

FIGURE 7-1 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

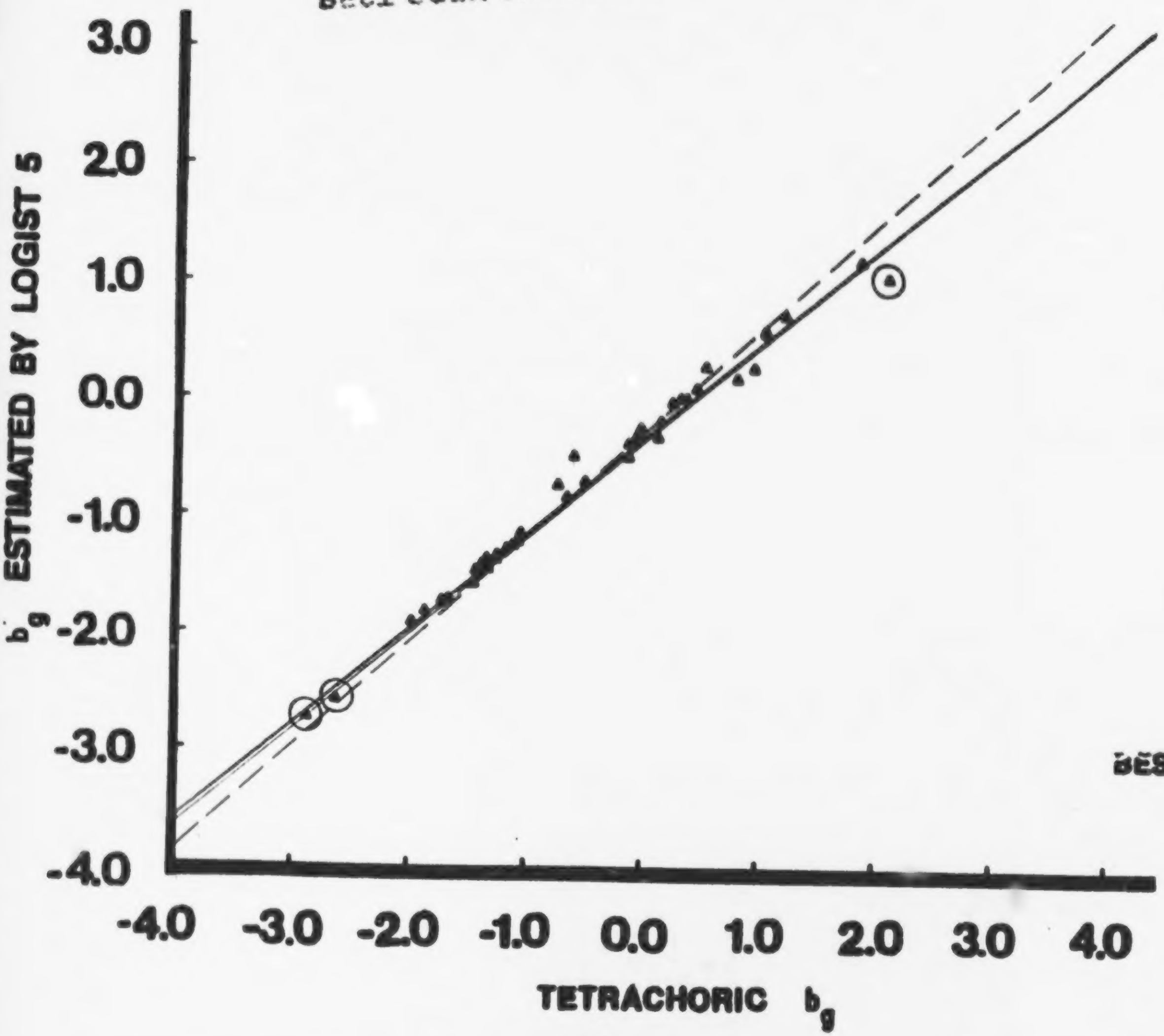

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FIGURE 7-2

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Solid, Thin Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. For the 43 Items of Test A5 Excluding Items A523 and A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

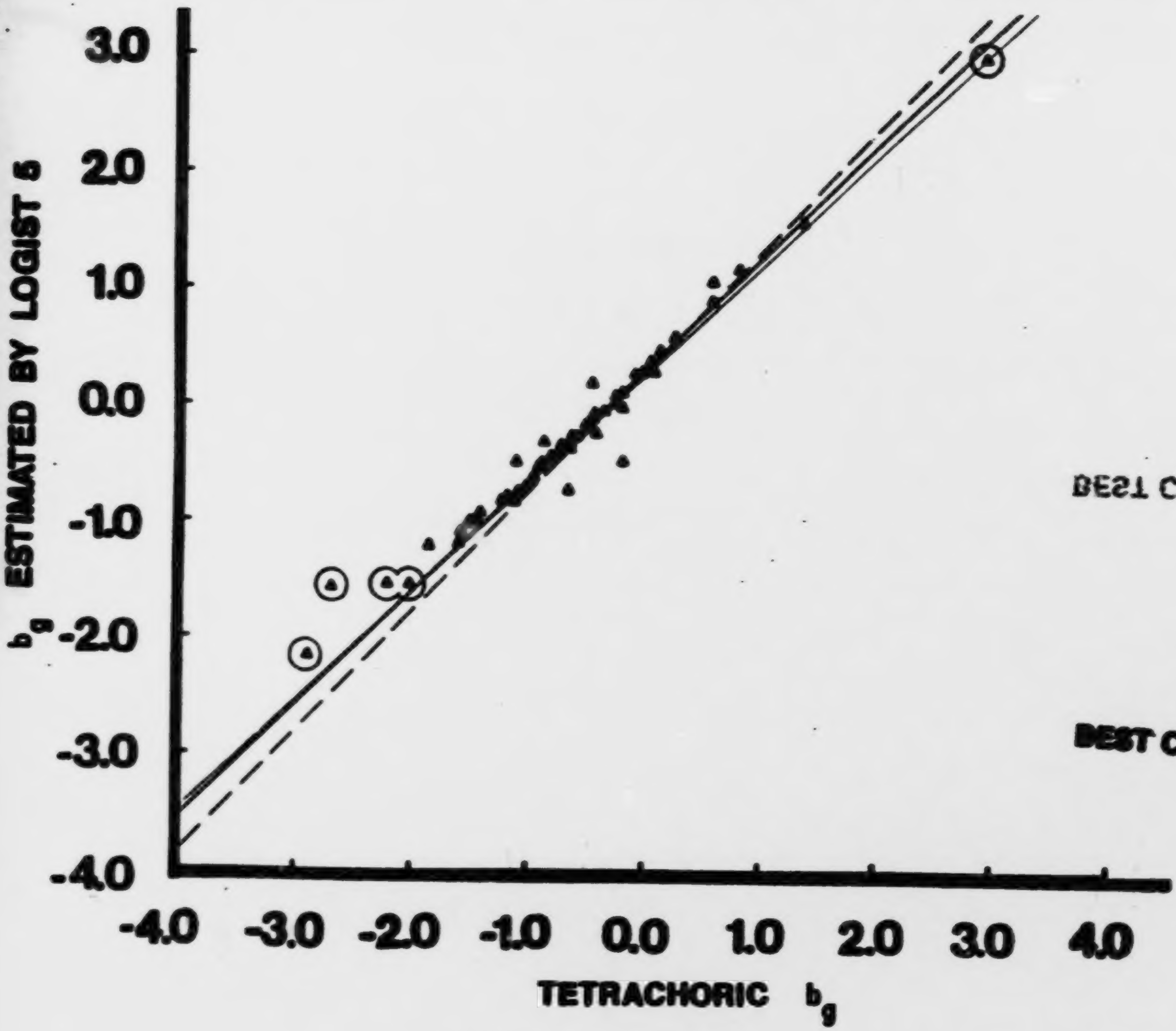

FIGURE 7-2 (Continued,

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

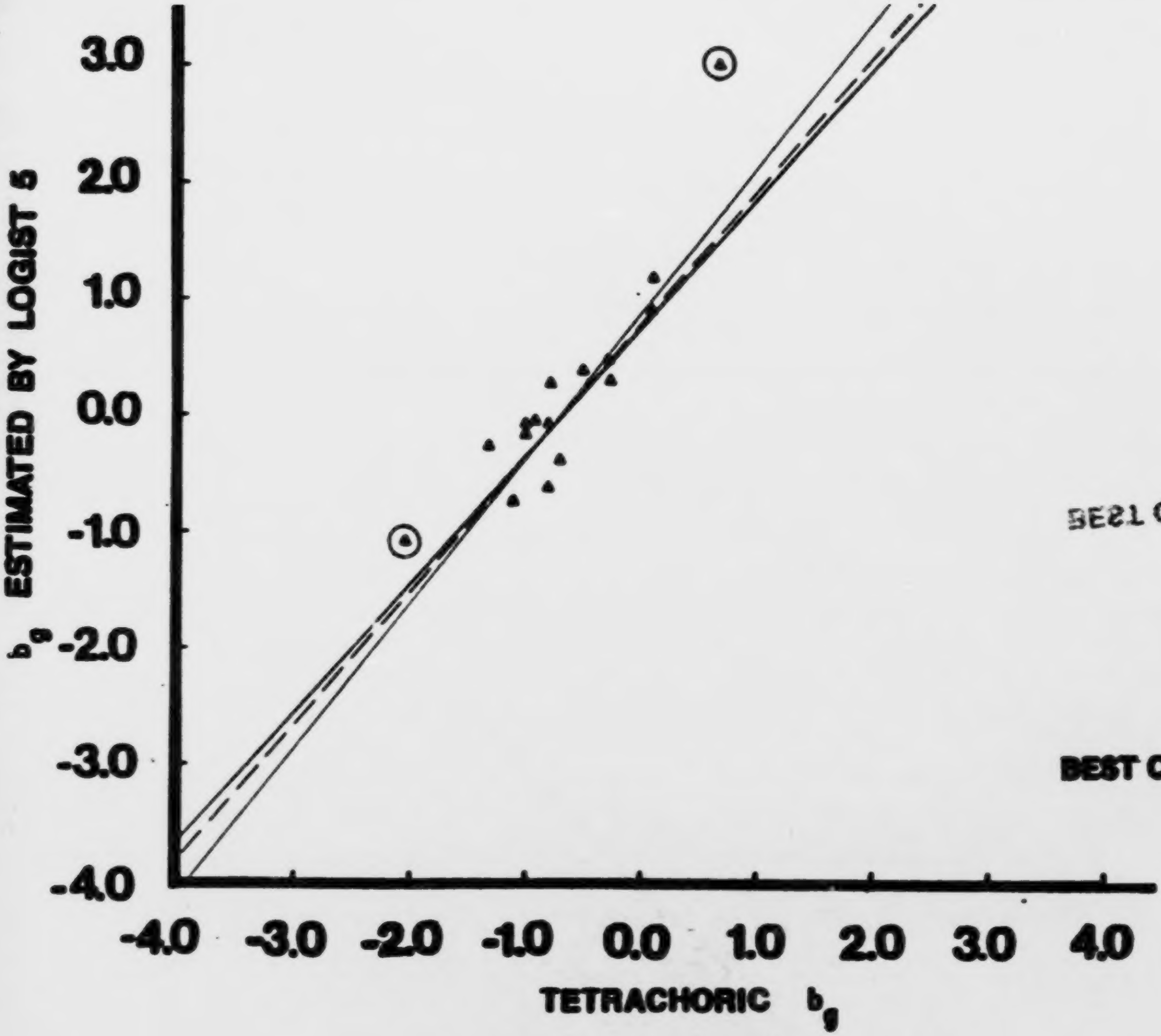

FIGURE 7-2 (Continued)

For the 16 Items Overlapping in Tests A6 and J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

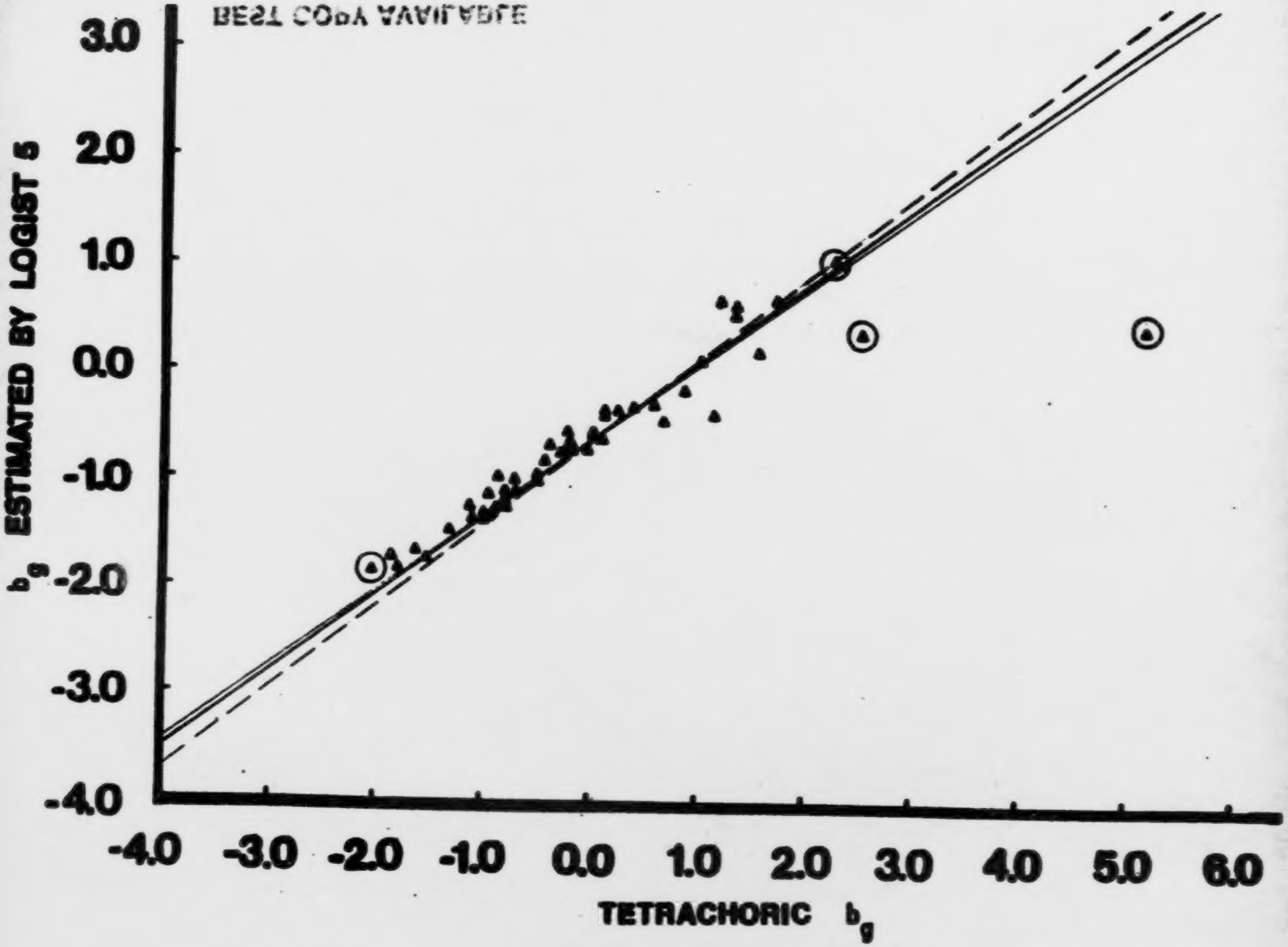

FIGURE 7-2 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

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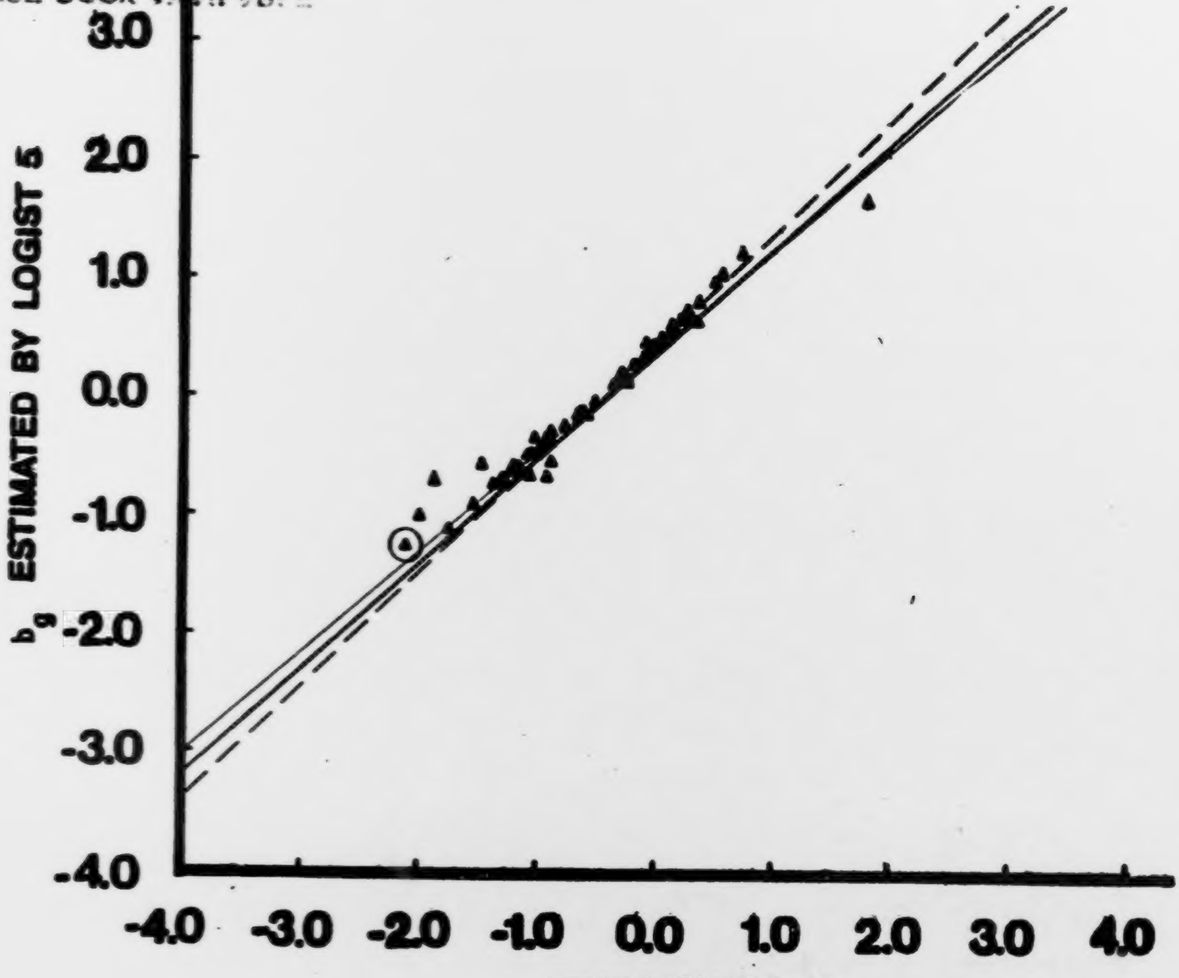

FIGURE 7-2 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

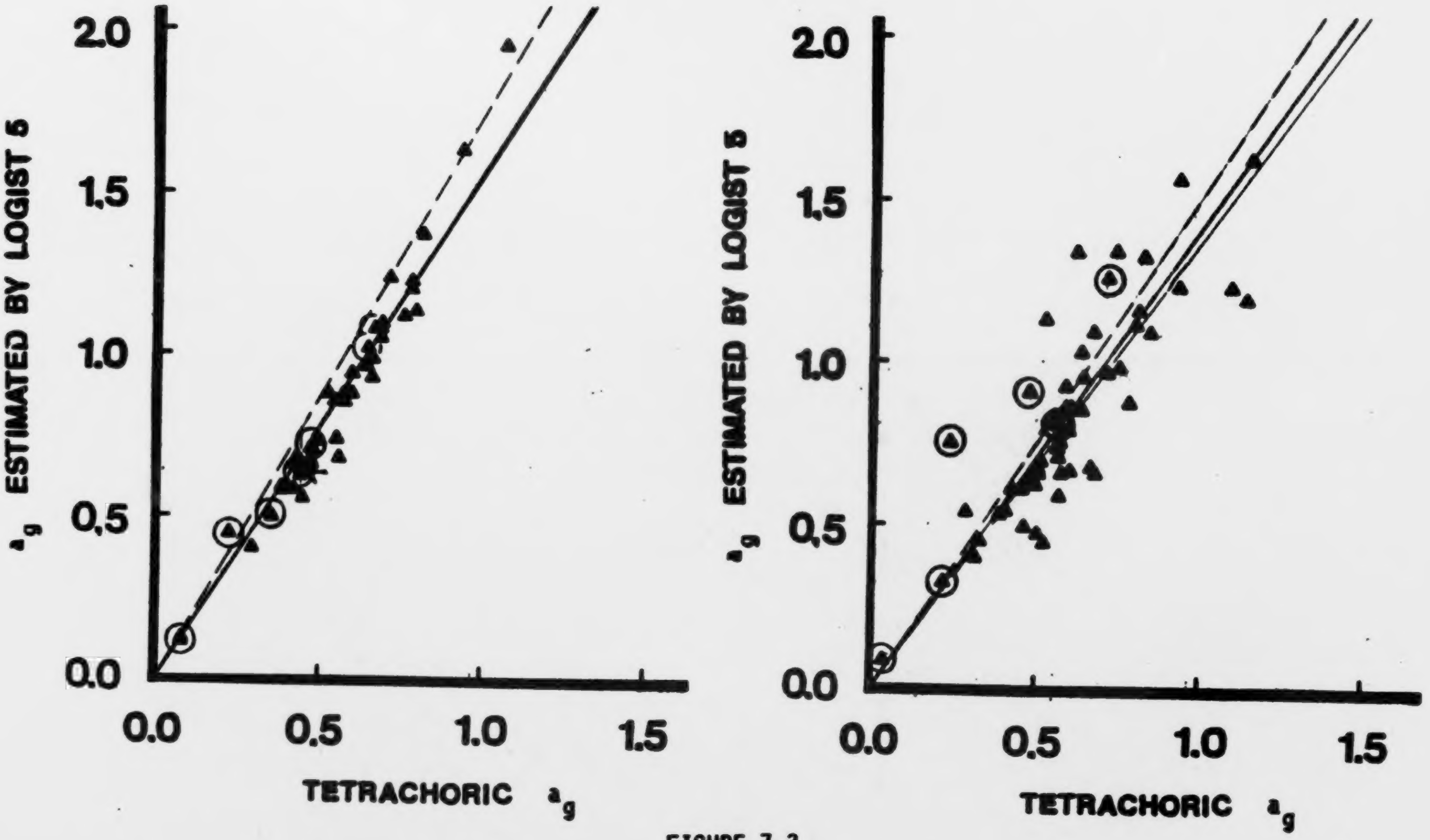

FIGURE 7-3

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6-J1-J2 on the Ordinate.

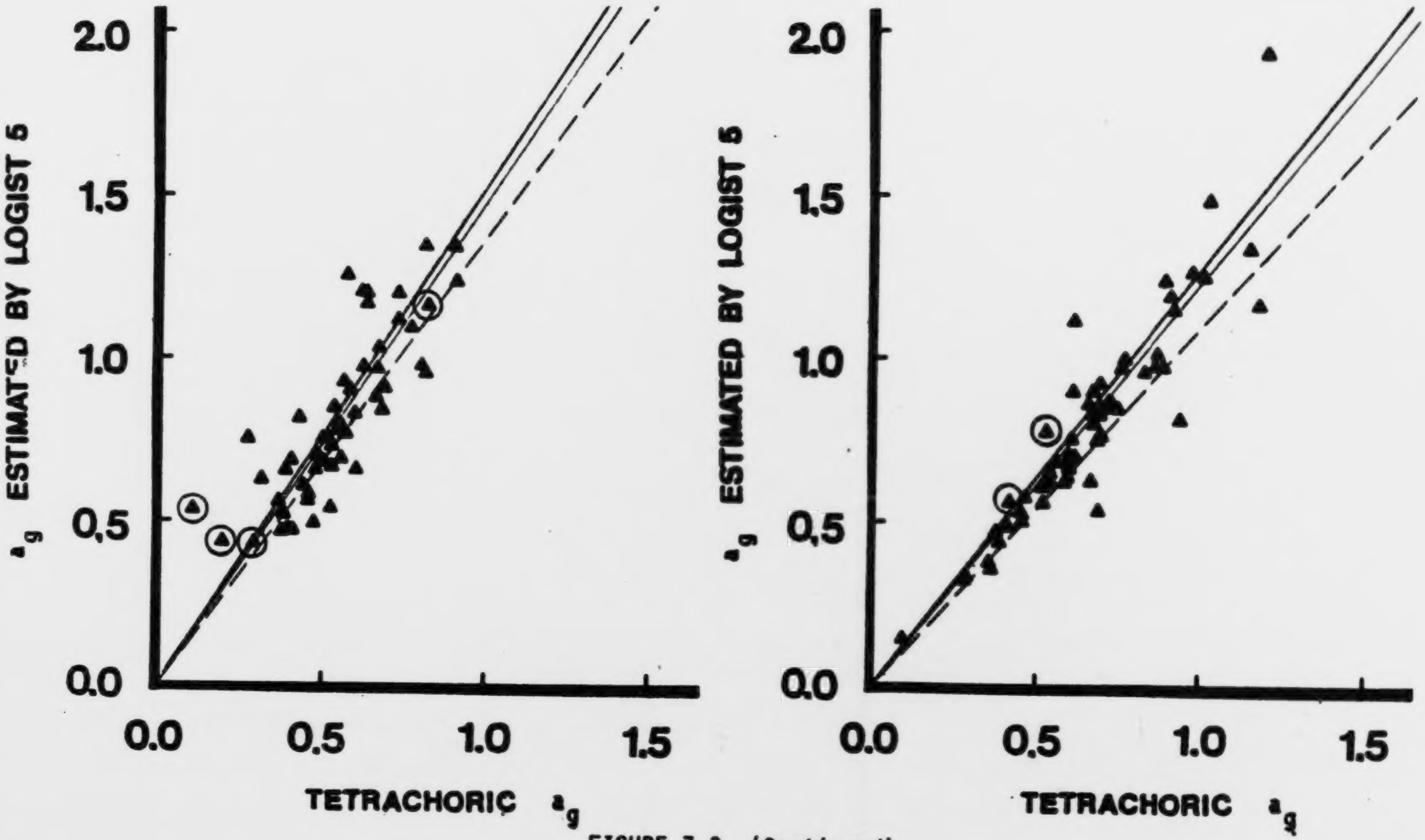

FIGURE 7-3 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

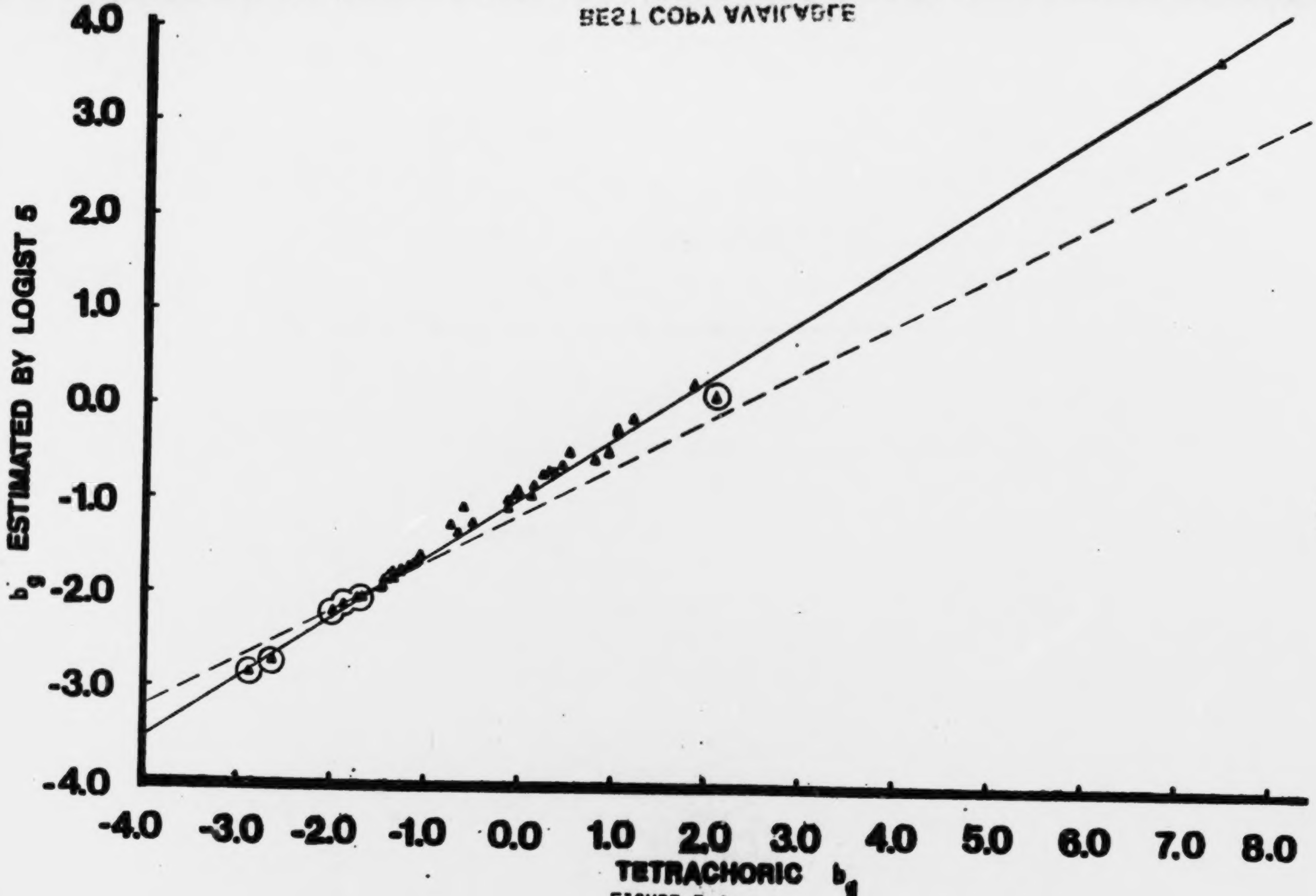

FIGURE 7-4

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. For the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

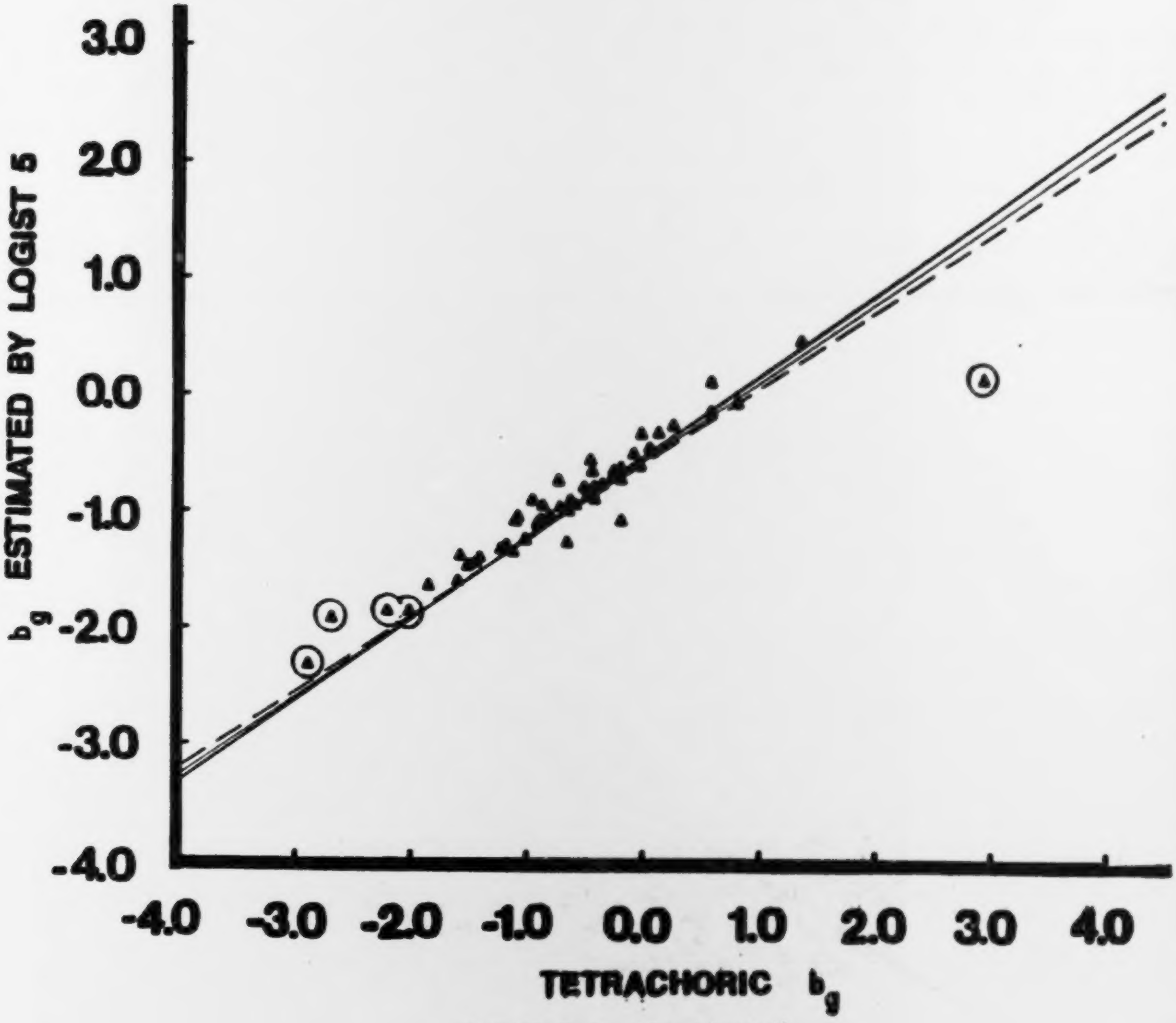

FIGURE 7-4 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

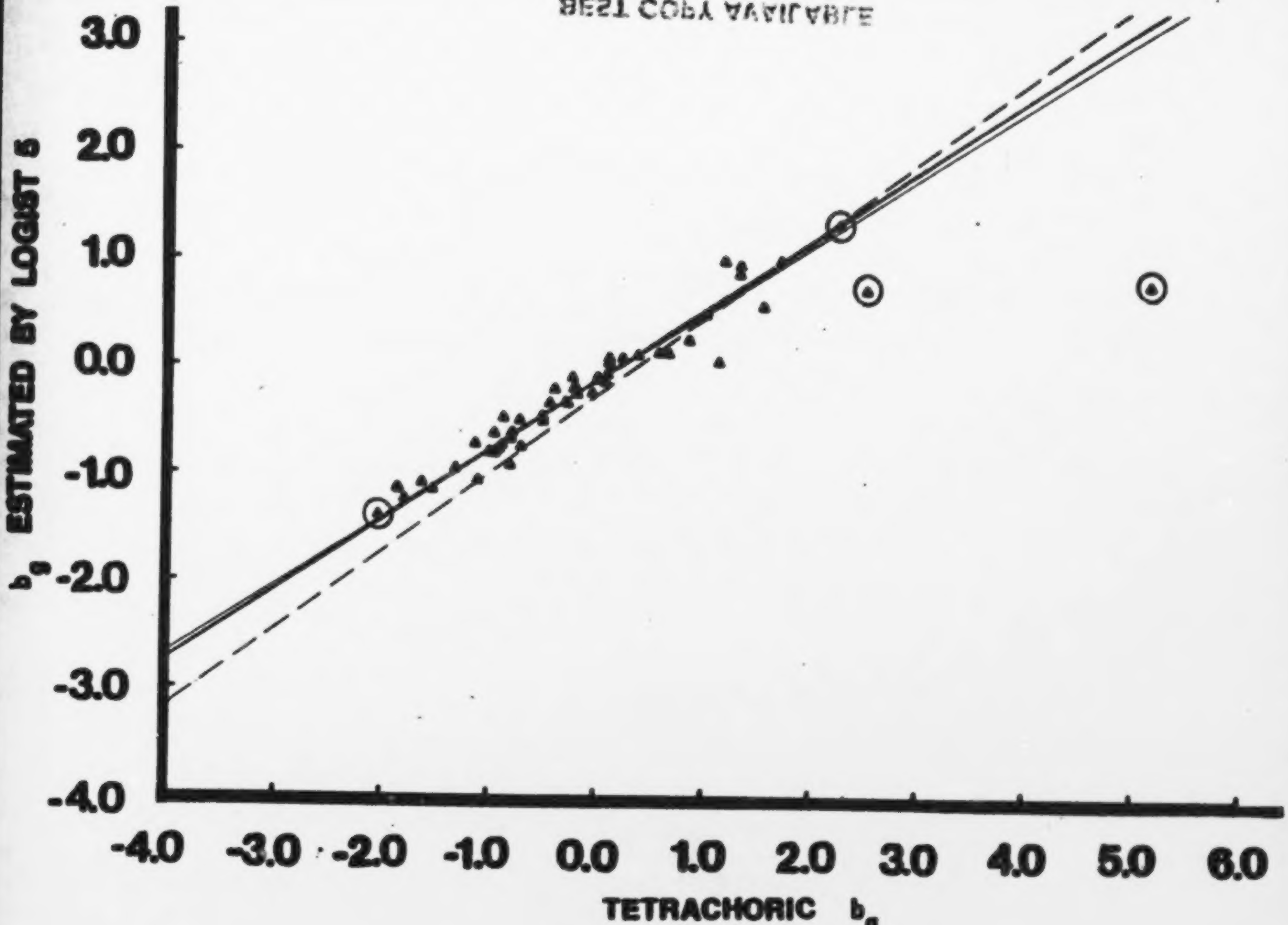

FIGURE 7-4 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

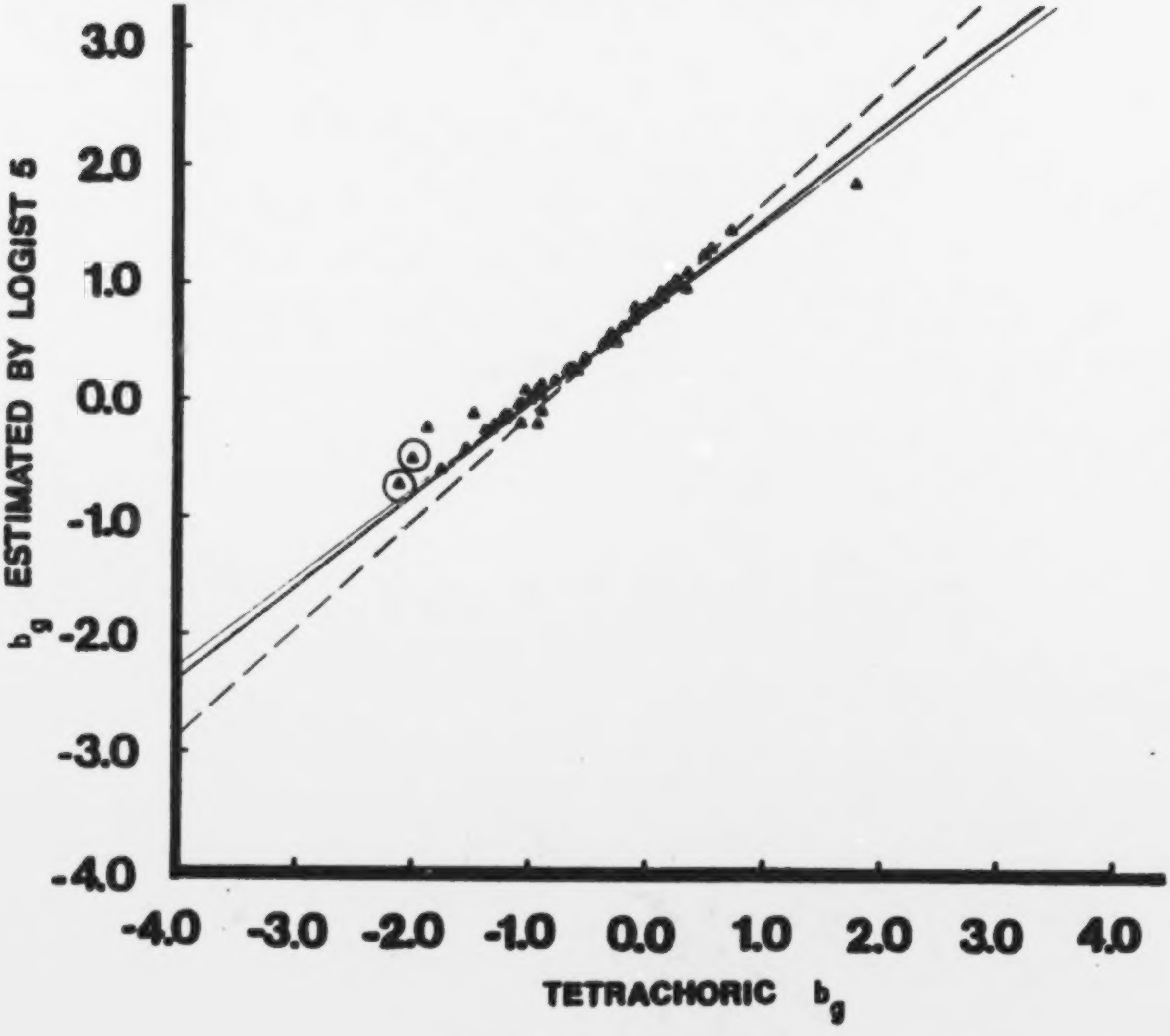

FIGURE 7-4 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

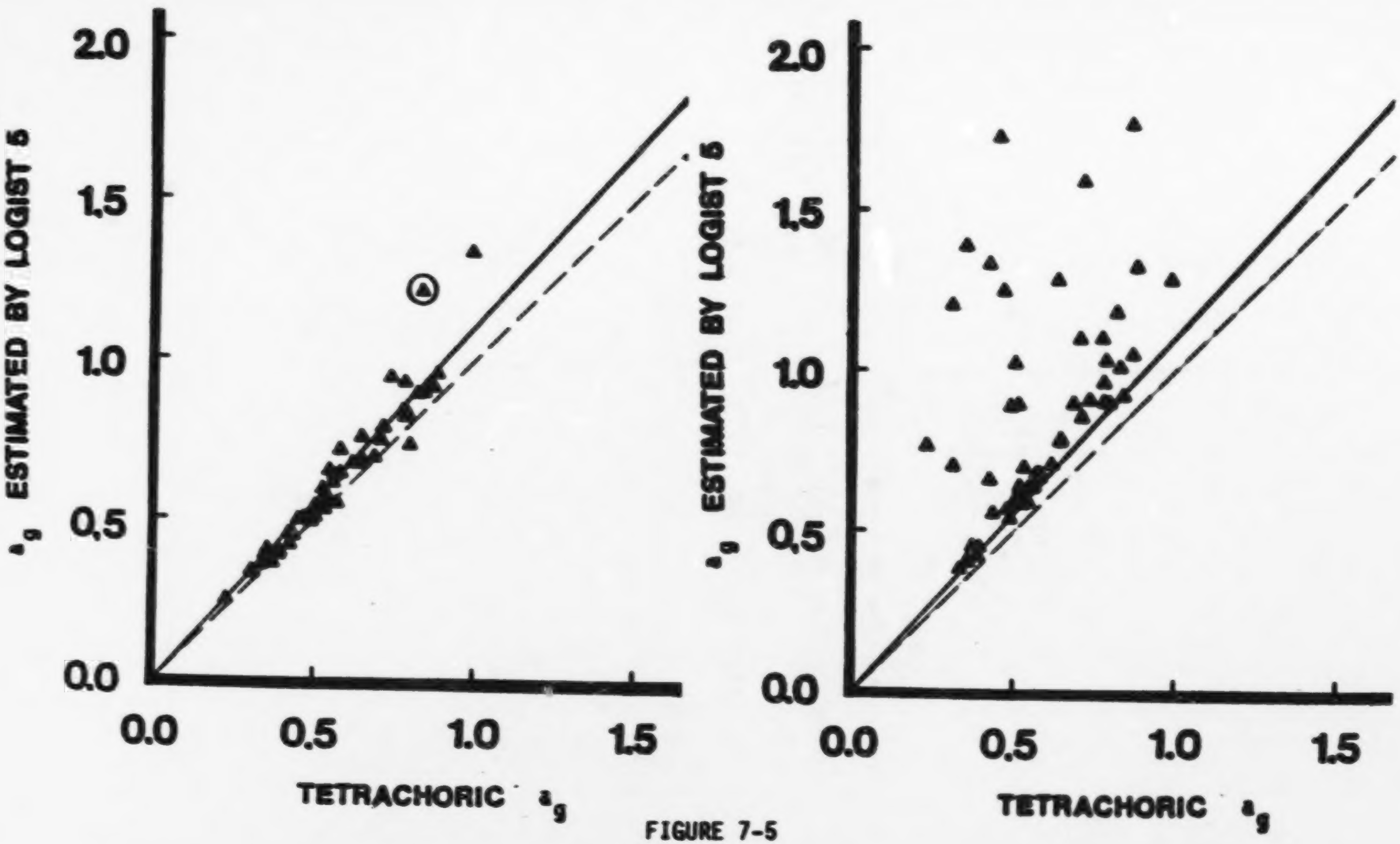

FIGURE 7-5

Estimated Item Discrimination Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Logistic Model Is Assumed in the Graph on the Left Hand Side And Three-Parameter Logistic Model Is Assumed in the Graph on the Right Hand Side. Both Sets of Estimates in Each Graph are the Original One, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship When the Logistic Model Is Asssumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. J1/1075 Case.

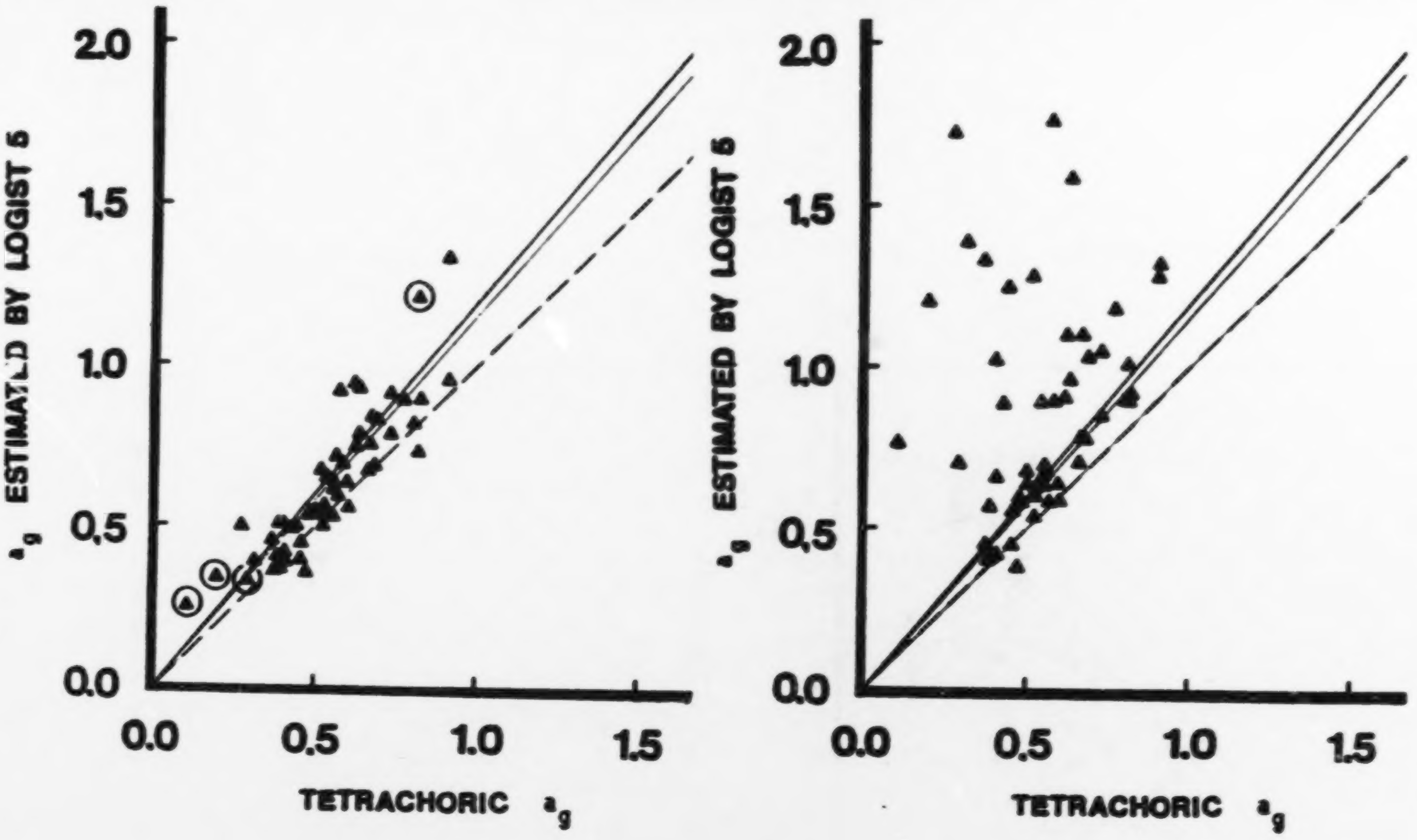

FIGURE 7-5 (Continued)

J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

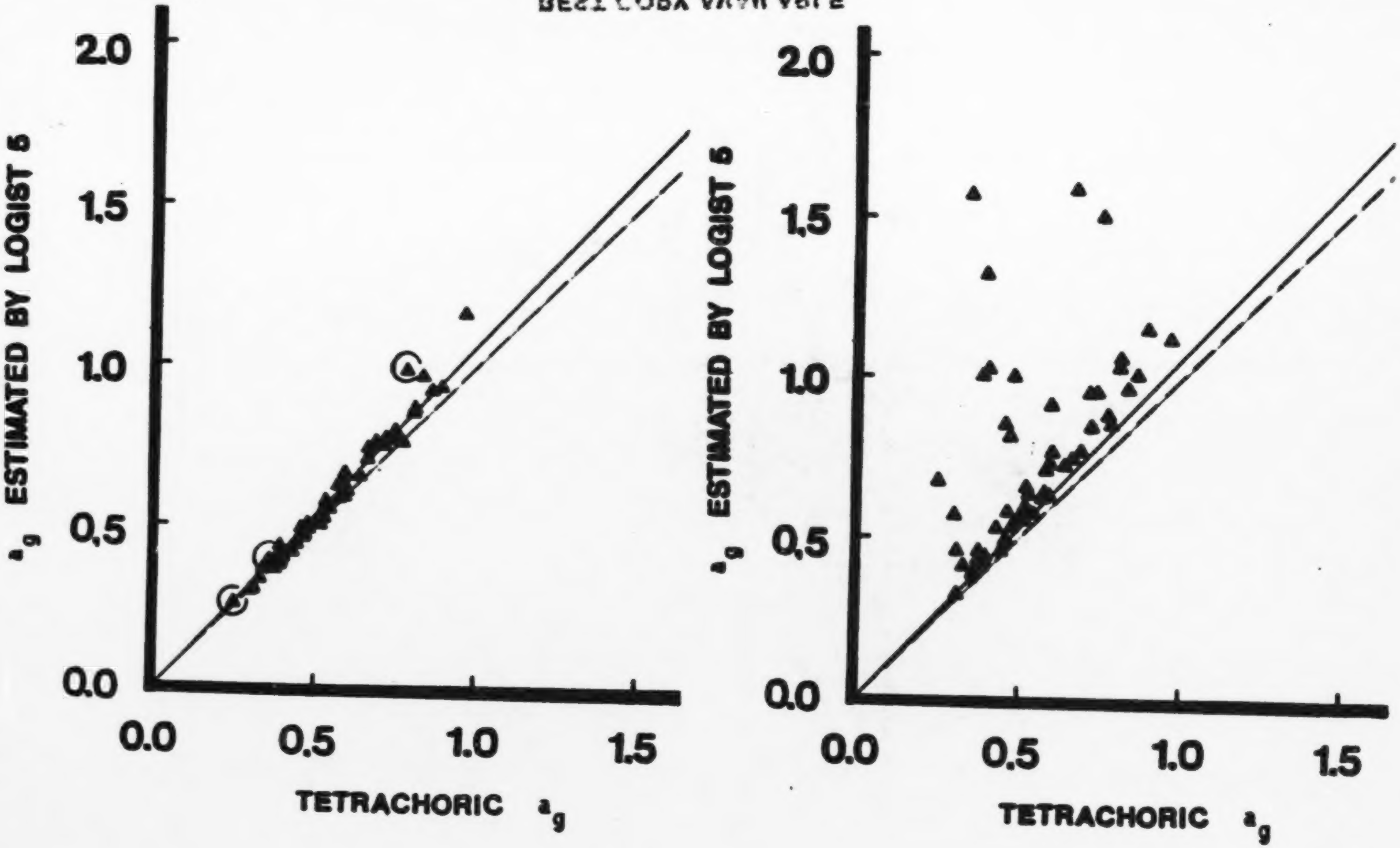

FIGURE 7-5 (Continued): J1/2259 Case.

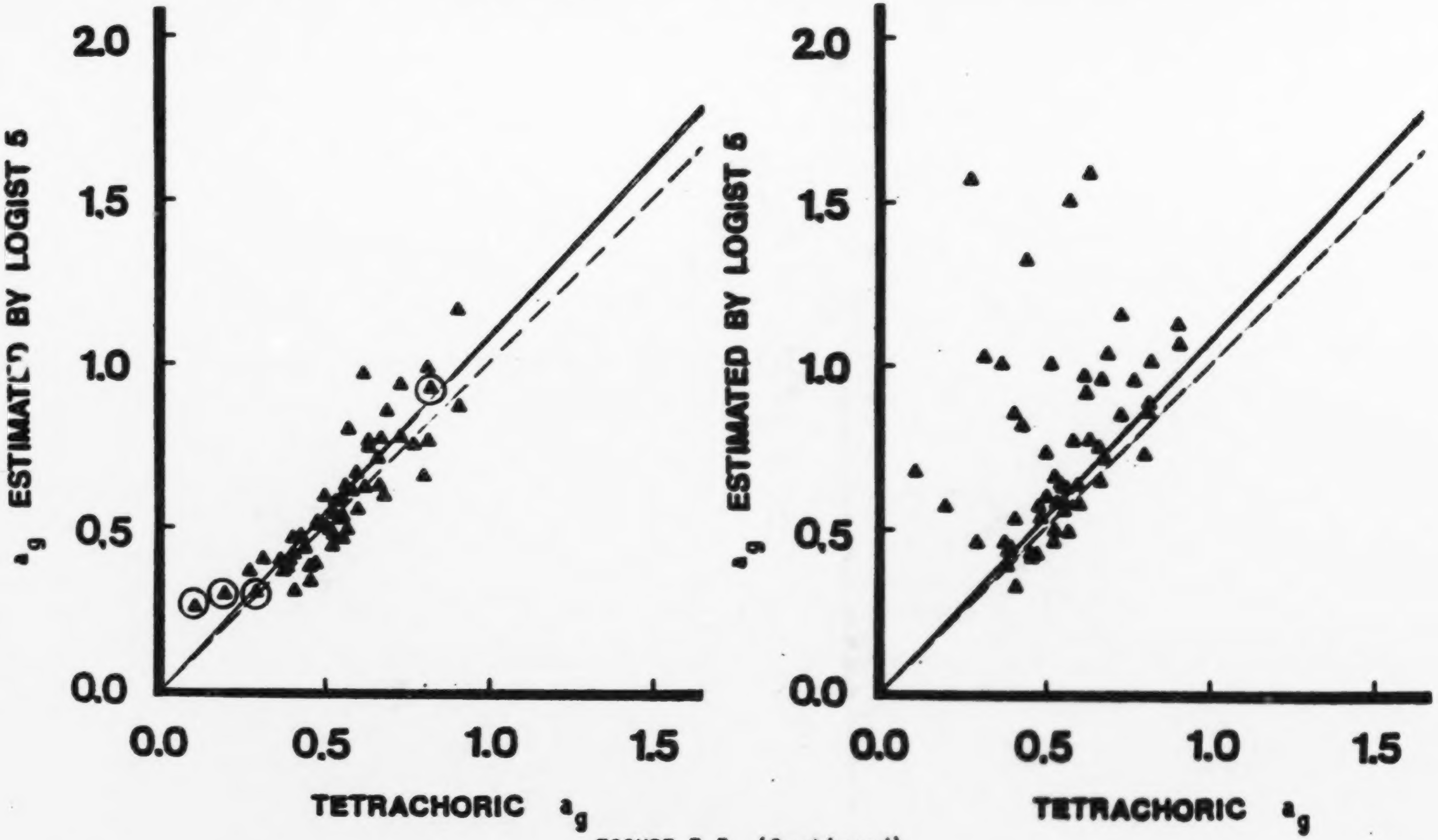

FIGURE 7-5 (Continued)

J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

each of which the Logist 5 results of "$c_g$-Zero" and "$c_g$-Free" are compared. The first two pairs concern with Case J1/1075 and the last two with Case J1/2259. In the first pair, these results are plotted against those of J1/1075 Case of the Tetrachoric Method, and in the second they are plotted against the results of J1/0614 Case of the Tetrachoric Method. In the third pair, the results of Case J1/2259: $c_g$-Zero and $c_g$-Free are plotted against those of J1/2259 Case of the Tetrachoric Method, and and in the fourth pair, they are plotted against the results of J1/0614 Case of the Tetrachoric Method. We can see a substantial consistency between the two sets of estimated item discrimination parameters in the first graph of each of the four pairs, i.e., when (two-parameter) logistic model is assumed in using Logist 5 , whereas there exists little consistency in the second graph of each pair, i.e., when three-parameter logistic model is assumed. We notice that the greatest consistency is observed in the first graph of the first pair of scatter diagrams and in the first pair of the third pair. They are Case J1/1075: $c_g$-Zero of Logist 5 against J1/1075 Case of the Tetrachoric Method and Case J1/2259: $c_g$-Zero against J1/2259 Case, i.e., the only two situations which concern the same examinee group both in using Logist 5 and in using Tetrachoric Method, and no guessing parameter is assumed in using Logist 5 . This fact suggests that these two methods provide us with consistent results when the item parameter configurations are such as those of Test J1, if the sample size is 1,000 or above. The corresponding eight scatter diagrams for the estimated item difficulty parameters are presented as Figure 7-6. We can see a similar tendency as we have observed for the estimated discrimination parameters, although inconsistency between the two sets of estimates is less conspicuous when three-parameter logistic model is assumed in using Logist 5 .

Figure 7-7 presents four graphs which clarify how estimated item parameters differ when three-parameter logistic model is assumed in comparison with those when (two-parameter) logistic model is assumed. The first two graphs concern with the group of 1,075 examinees and the last two with the group of 2,259 examinees, and in each pair the first graph concerns with the adoption of the (two-parameter) logistic model and the second with the three-parameter logistic model. In each graph, the estimated item difficulty parameters of the items of Test J1 are taken on the abscissa, and the estimated discrimination parameters are taken on the ordinate. Both the results of the Tetrachoric Method and those of Logist 5 are plotted in each of the four graphs, to make the total number of points 110. To avoid confusion, there are five different symbols, i.e., ▲ , ✸ , ♠ , ◆ and + , in these graphs, and an arrow is drawn for each item from the point indicating the result of the Tetrachoric Method to that of Logist 5 .

Comparison of the first graph of Figure 7-7 with the second, and of the third graph with the fourth, excloses how radically the two estimated parameters of these items of Test J1 are enhanced because of the existence of the guessing parameter $c_g$ when three-parameter logistic model is assumed in using Logist 5 . These tendencies are

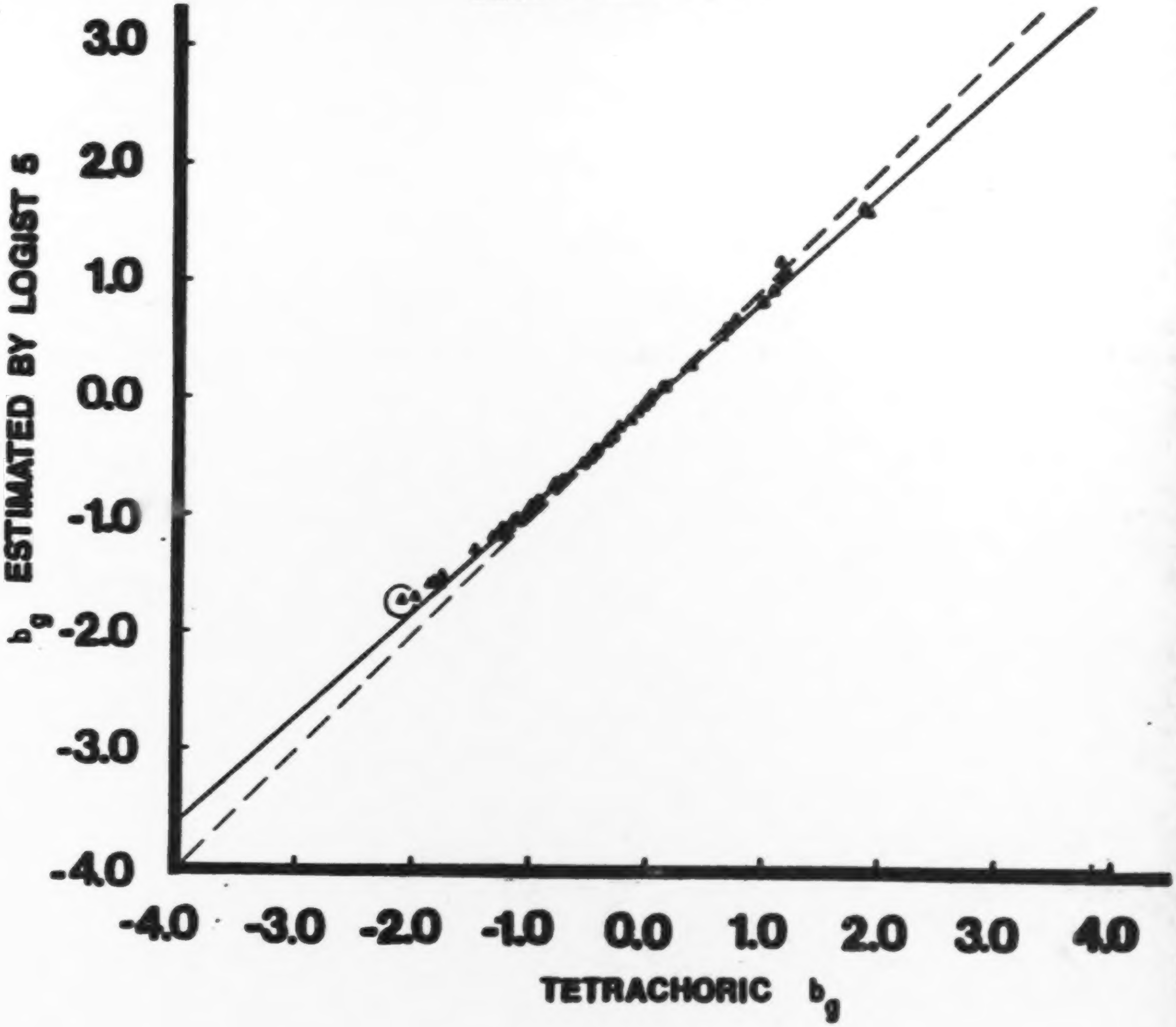

FIGURE 7-6

Estimated Item Difficulty Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. Both Sets of Estimates in Each Graph Are the Original One, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

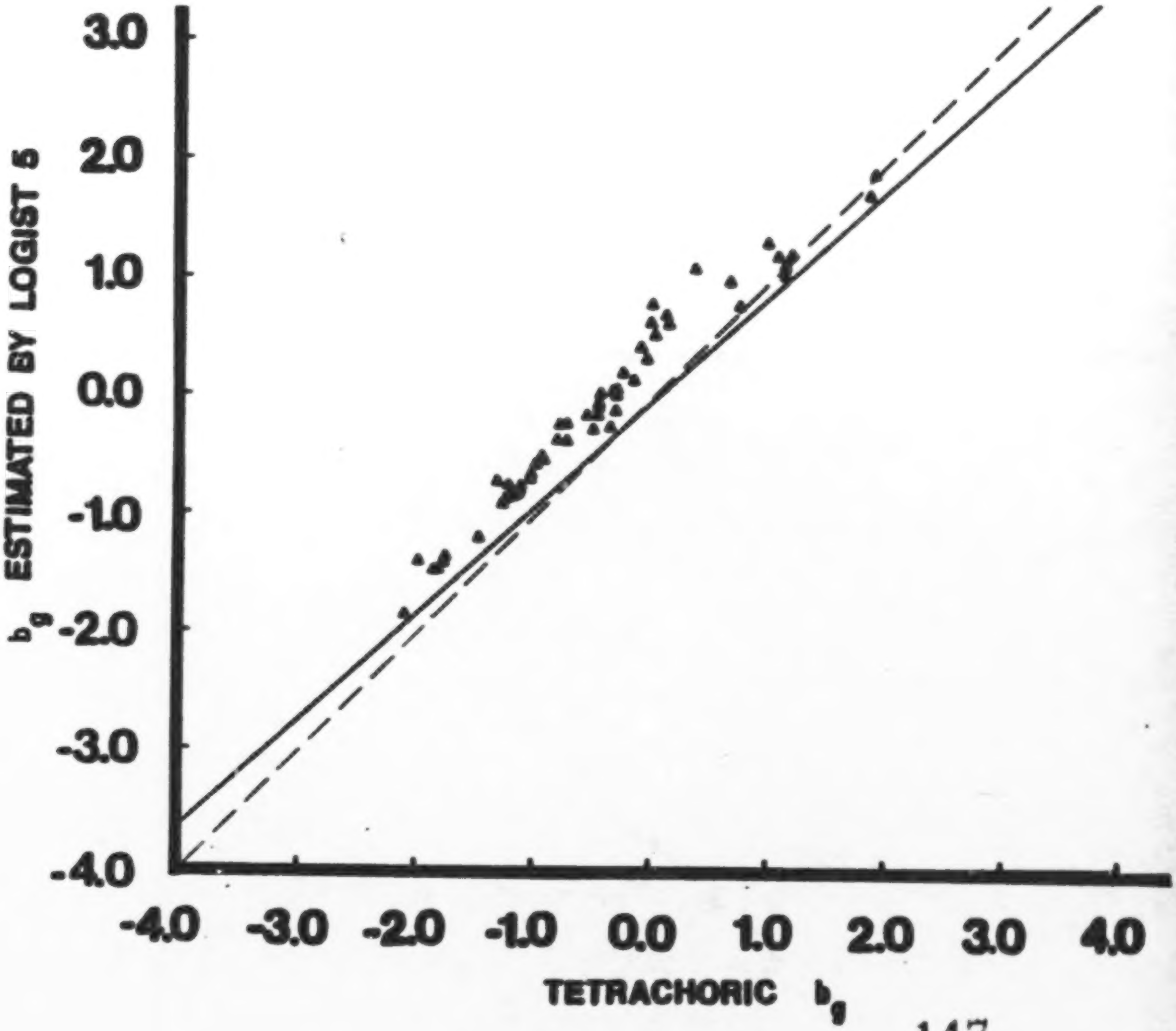

FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

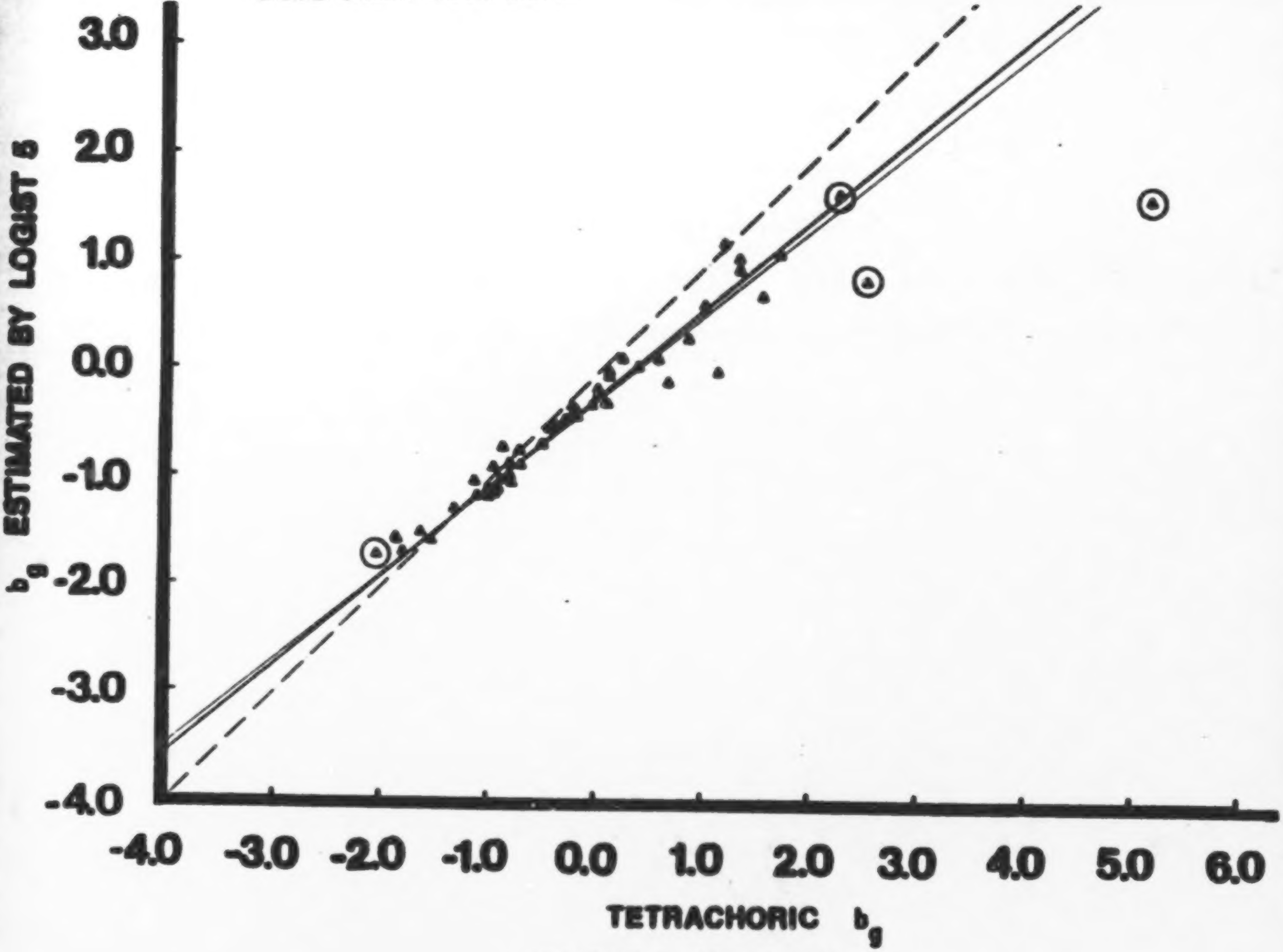

FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

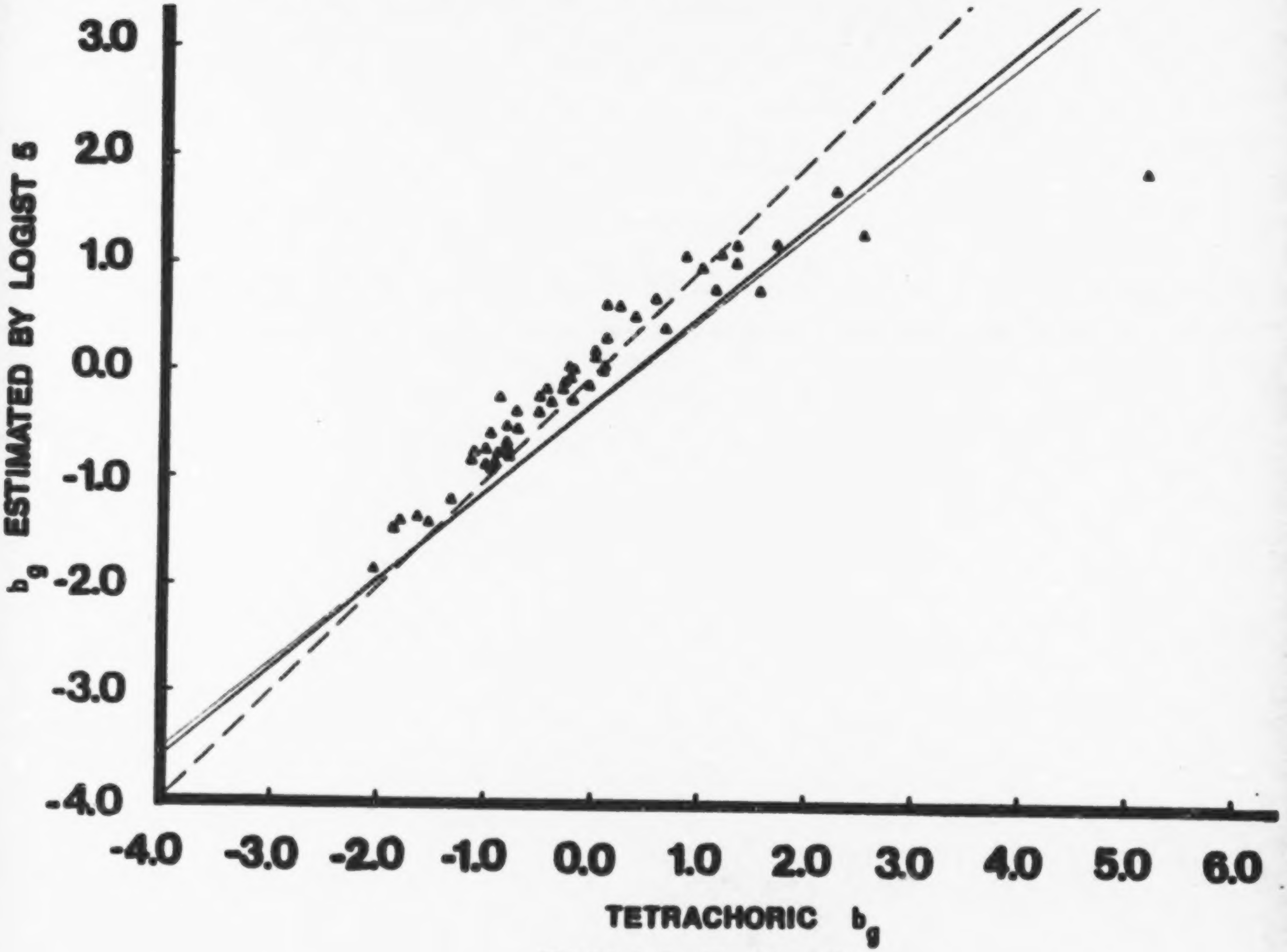

FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

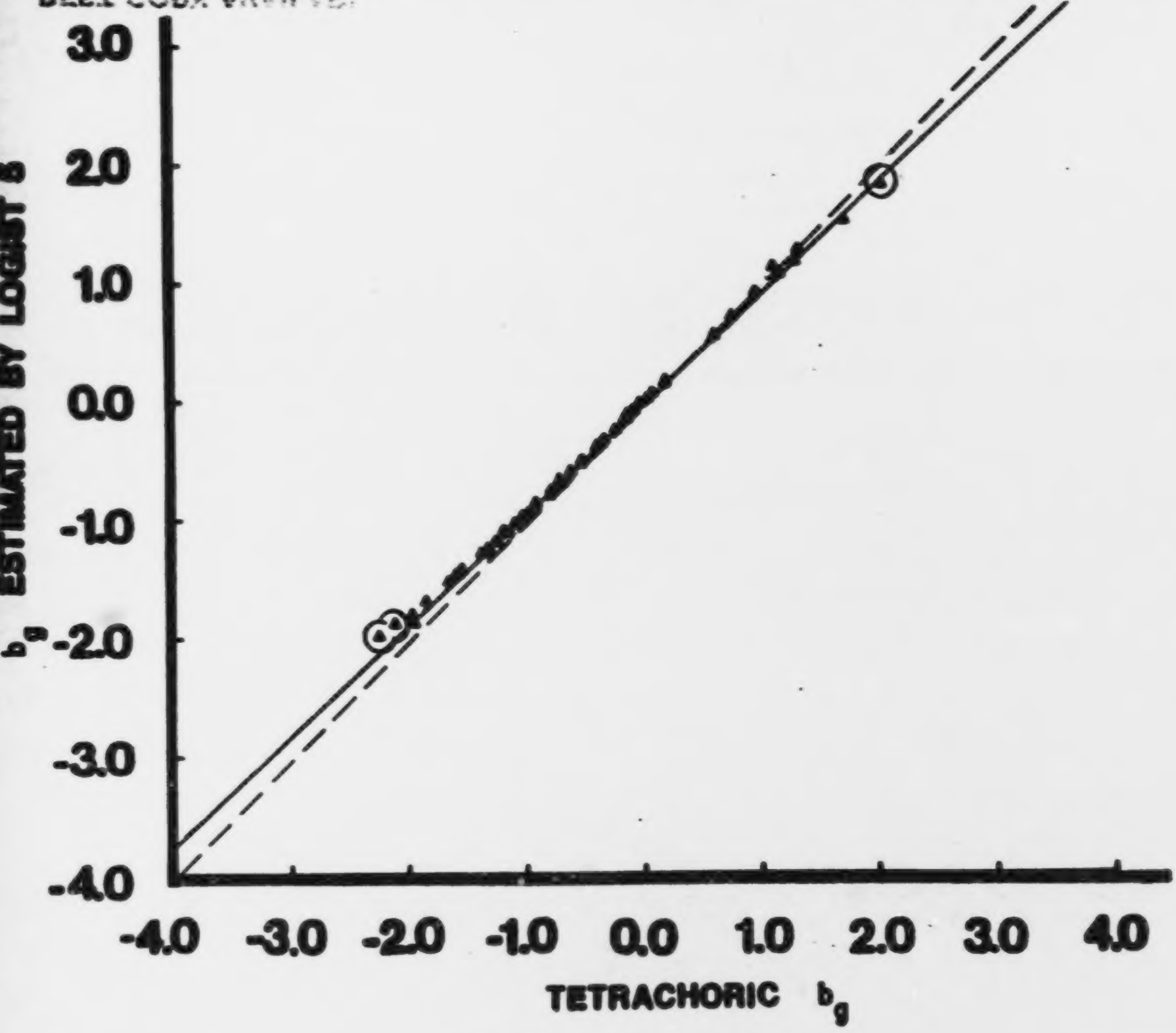

FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

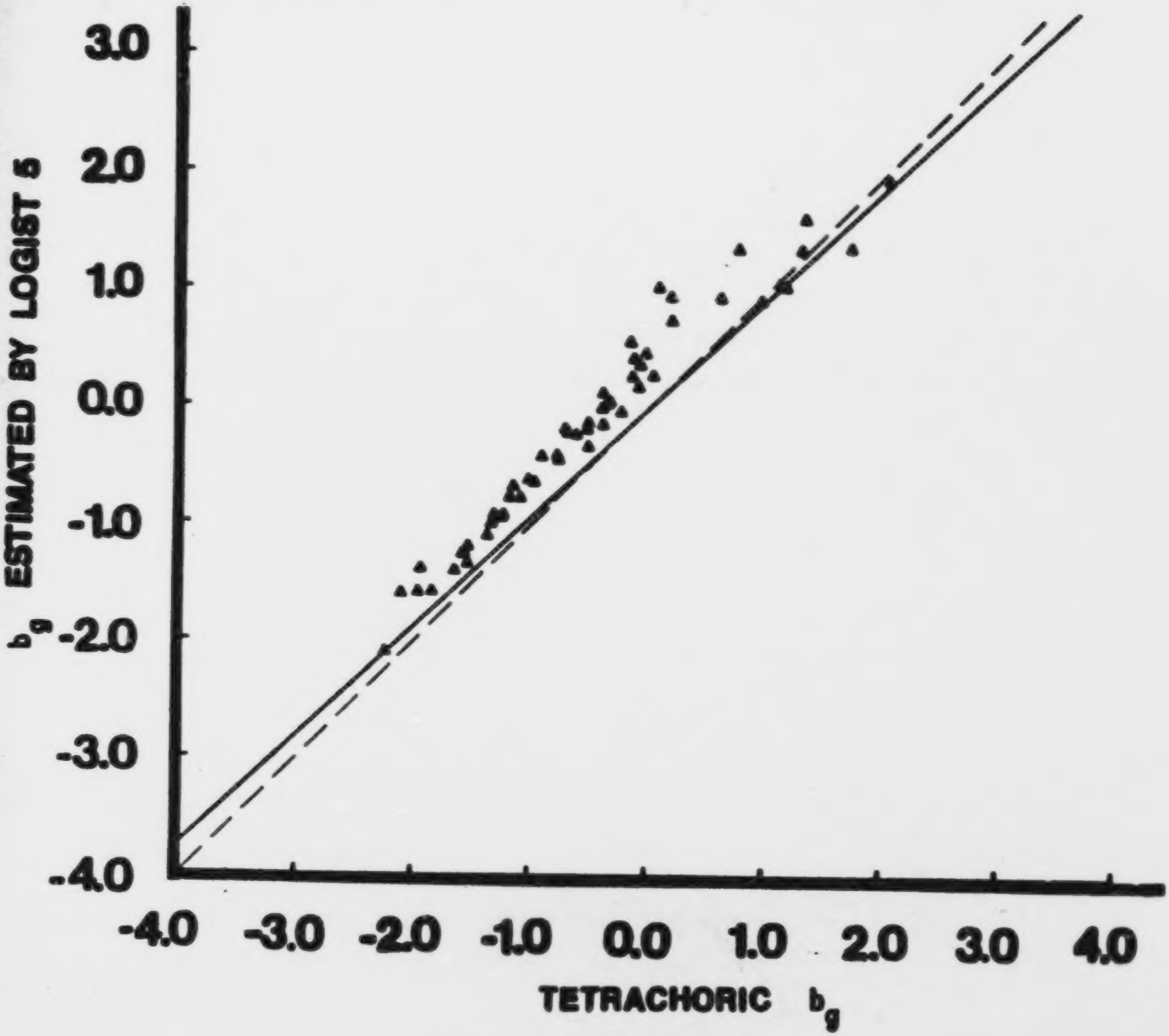

FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist-5. J1/2259 Case.

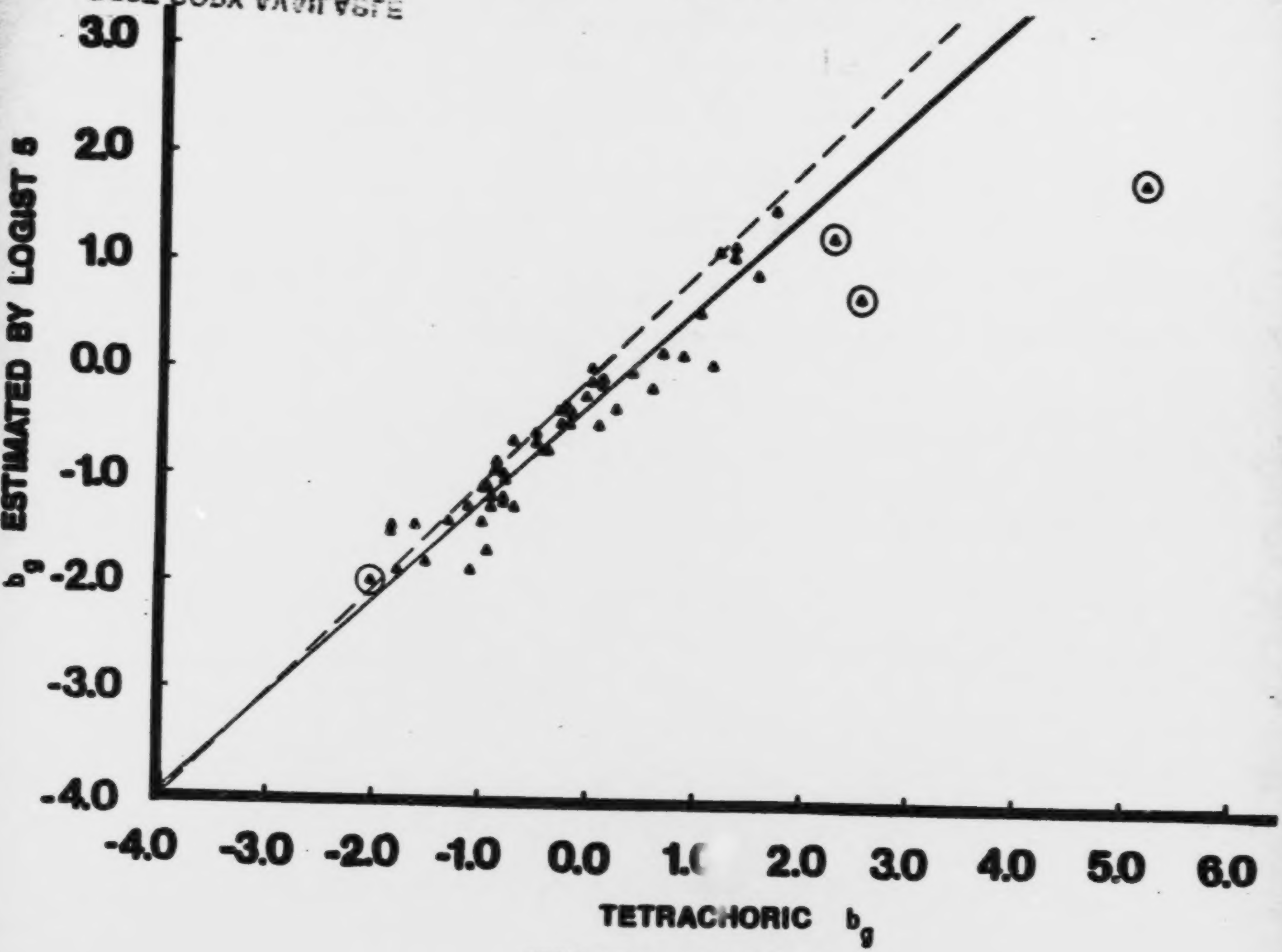

FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

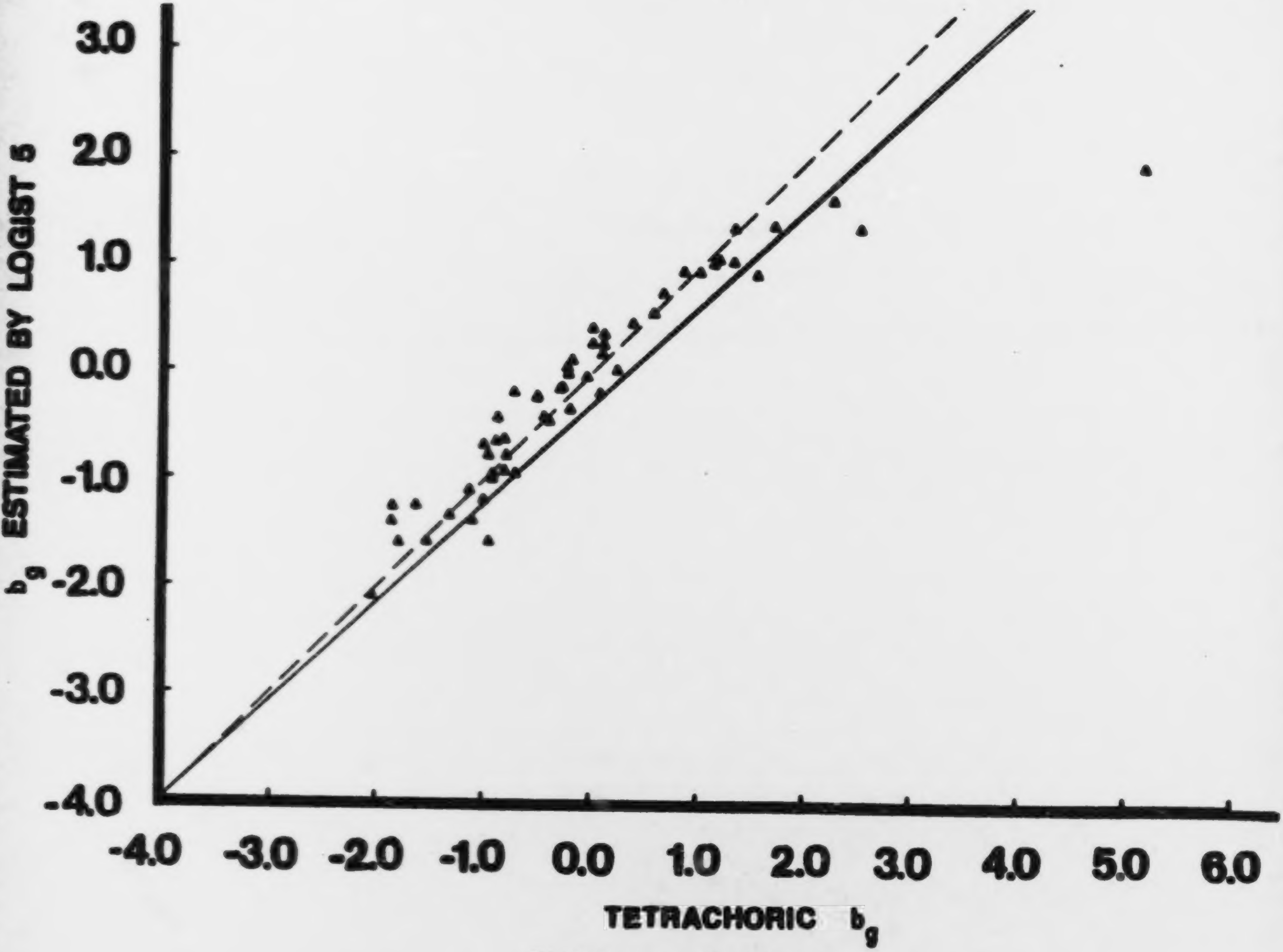

FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

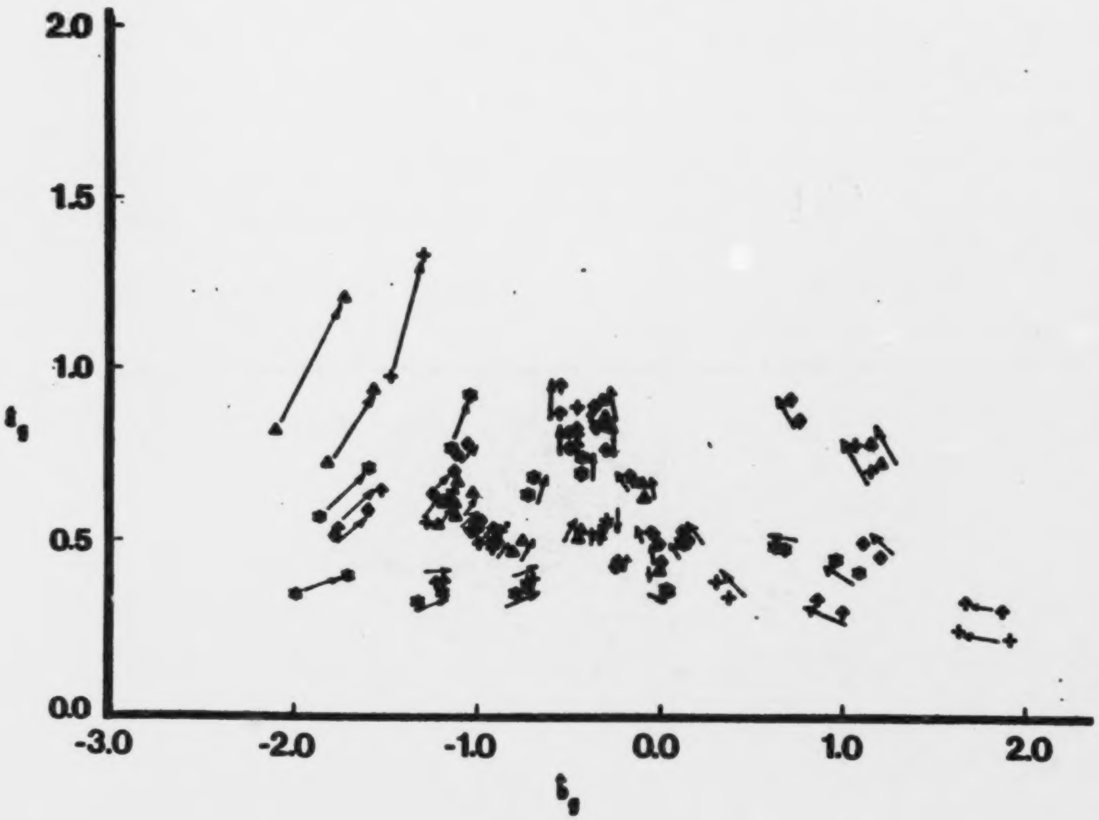

FIGURE 7-7

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$ , Which Were Obtained by the Tetrachoric Method Applied for the J1/1075 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming (Two-Parameter) Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

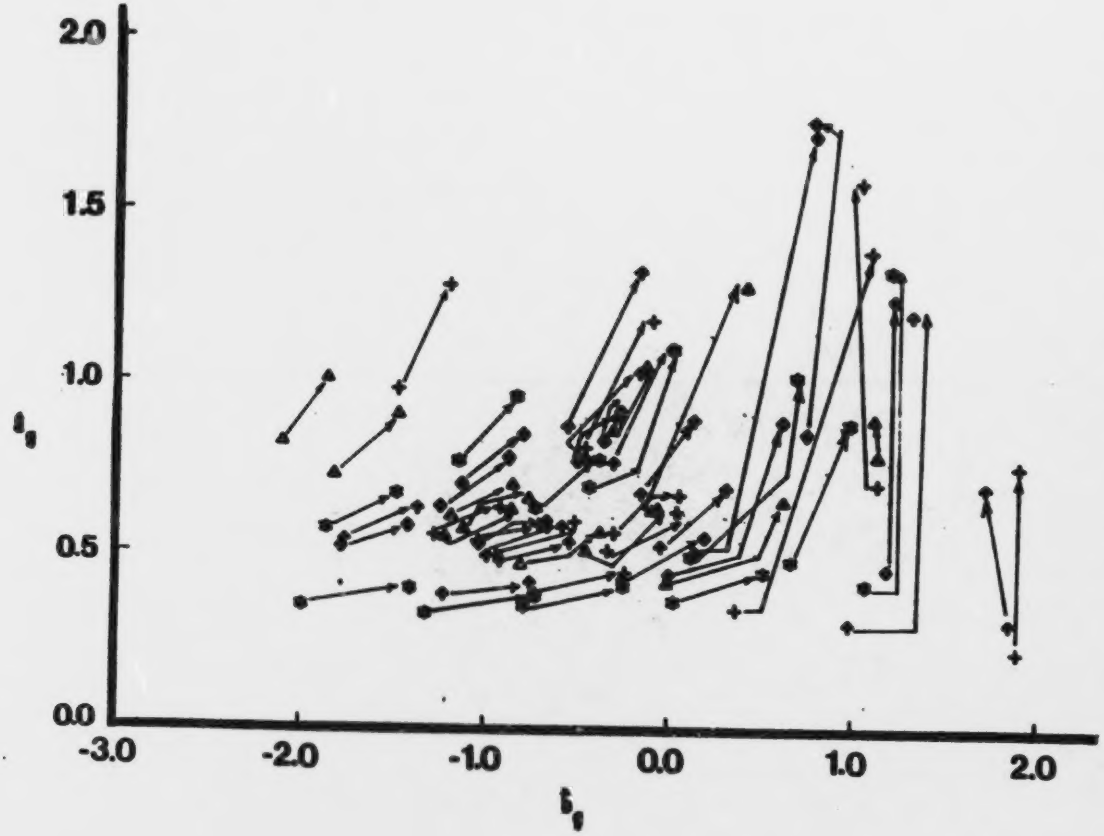

FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$, Which Were Obtained by the Tetrachoric Method Applied for the J1/1075 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming Three-Parameter Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

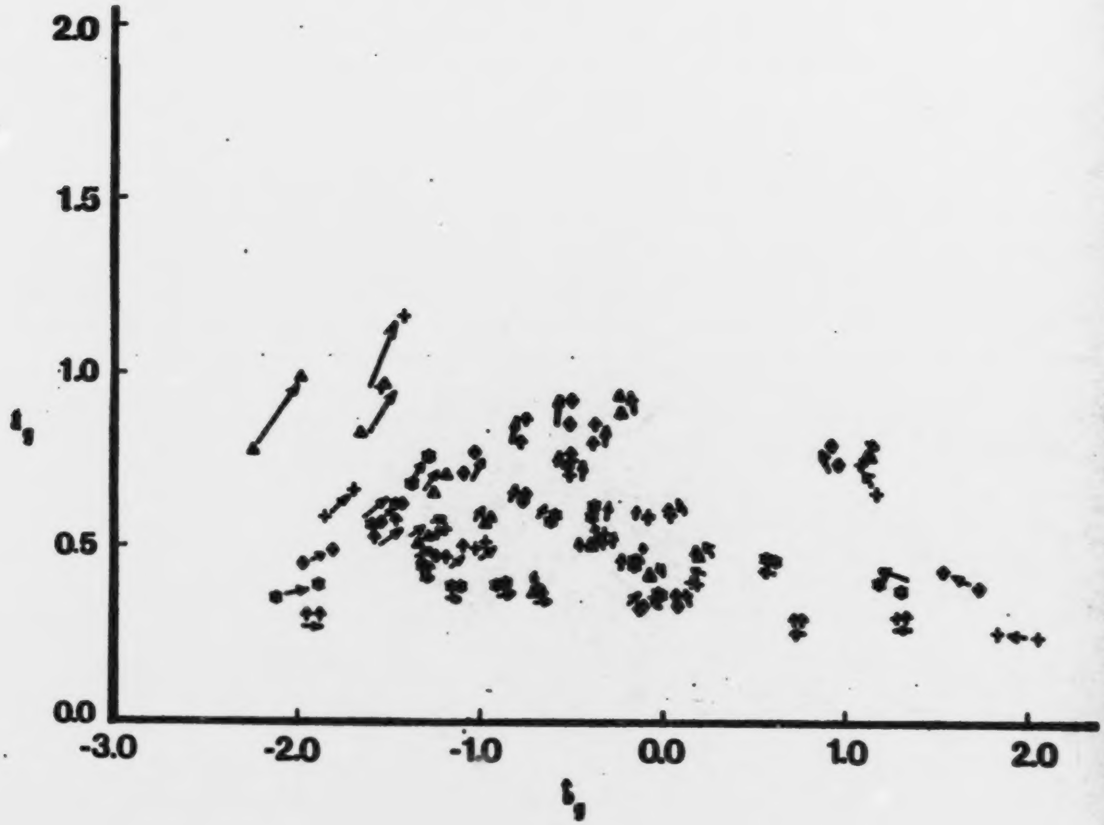

FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$ , Which Were Obtained by the Tetrachoric Method Applied for the J1/2259 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming (Two-Parameter) Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

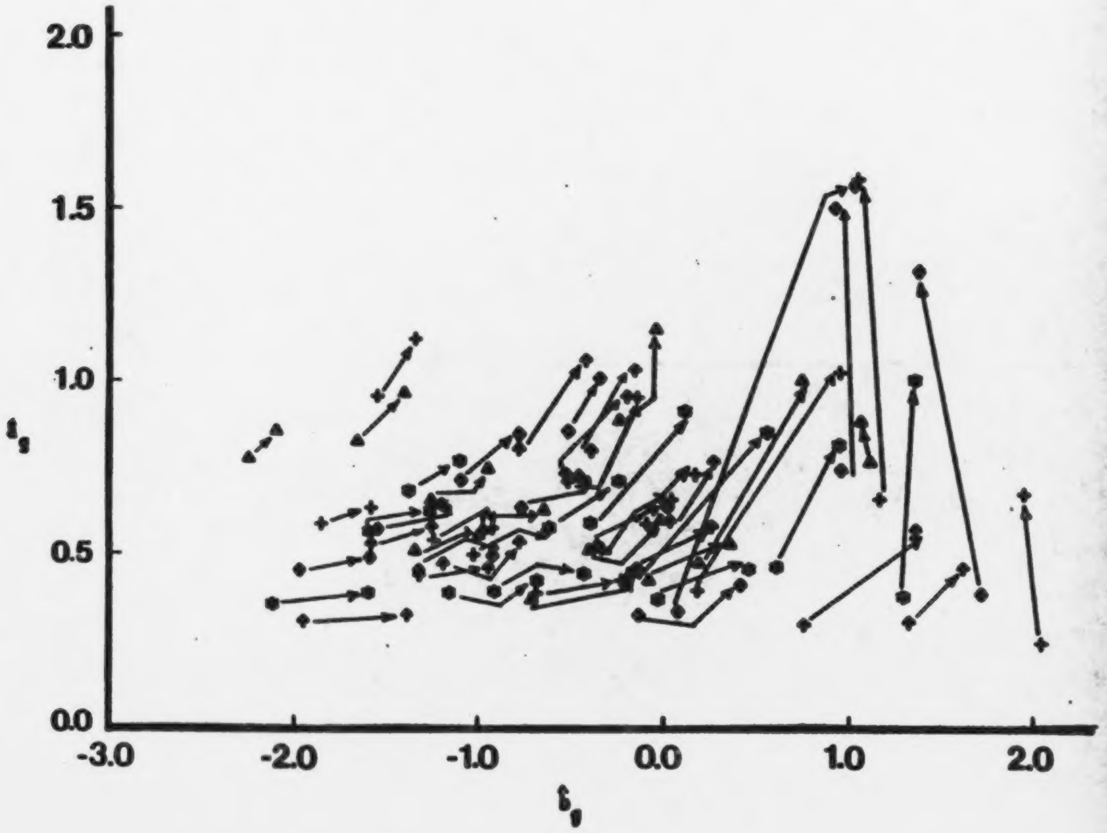

FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$, Which Were Obtained by the Tetrachoric Method Applied for the J1/2259 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming Three-Parameter Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

similarly observed in both pairs, where the examinee groups of 1,075 individuals and of 2,259 examinees are involved, respectively.

We assume, tentatively, that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ equals those of $\theta$ for each examinee group. We recall that, in the preceding section, we obtained the estimated mean and the standard deviation of the distribution of $\theta$ for each of the three combined groups, and they are presented at the bottom of Table 6-3. Thus using the estimated mean and standard deviation of $\theta$ for each of the three combined examinee groups, and for each of J1/1075 and J1/2259 Cases, which are presented in Table 6-3 in the preceeding section, the scale adjustment was made in the same way as we did for the results of the Tetrachoric Method. The resulting "rescaled" estimated item parameters are shown in Tables 7-13 through 7-24, for each item of Tests A5, A6, J1 and J2, which were originally obtained by Logist 5 in Cases A5-A6, J1-J2, A5-A6-J1-J2, J1/1075: $c_g$-Zero, J1/1075: $c_g$-Free, J1/2259: $c_g$-Zero, and J1/2259: $c_g$-Free, respectively. Again in these tables, for convenience, extreme values of $a_g$ and $b_g$ in Tables 7-13 through 7-21 and in Table 7-23 are marked with ● in the same way as we did in Tables 6-4 through 6-9. Note that these marks indicate extreme deviation with respect to the origin and unit of the single scale, which are set equal to the mean and standard deviation of the ability distribution of the J1/0614 Case, respectively, while those marks in each of Tables 7-1 through 7-9 and in Table 7-11 do with respect to the origin and unit which are set equal to the mean and

## TABLE 7-13

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$ .

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.922 | -2.221 |
| A502 | 0.643 | -3.099● |
| A503 | 0.733 | -3.224● |
| A504 | 0.770 | -1.999 |
| A505 | 0.971 | -2.301 |
| A506 | 0.576 | -1.984 |
| A507 | 0.614 | -0.997 |
| A508 | 0.948 | -1.805 |
| A509 | 1.768 | -1.904 |
| A510 | 0.793 | -0.986 |
| A511 | 0.597 | -2.097 |
| A512 | 0.851 | -1.877 |
| A513 | 1.271 | -2.636 |
| A514 | 1.111 | -1.831 |
| A515 | 0.590 | -2.206 |
| A516 | 0.526 | 0.323 |
| A517 | 2.186 | -2.243 |
| A518 | 0.462 | -2.382 |
| A519 | 0.868 | -1.912 |
| A520 | 0.451 | -2.965 |
| A521 | 0.792 | -1.886 |
| A522 | 0.503 | -0.714 |
| A523 | 0.103 | 4.123● |
| A524 | 0.541 | -1.993 |
| A525 | 1.239 | -1.943 |
| A526 | 1.088 | -0.883 |
| A527 | 0.109 | -0.480 |
| A528 | 0.526 | -0.205 |
| A529 | 0.661 | -0.638 |
| A530 | 0.775 | -1.715 |
| A531 | 0.036● | 35.061● |
| A532 | 0.632 | -0.084 |
| A533 | 0.978 | -1.779 |
| A534 | 1.011 | -2.091 |
| A535 | 0.781 | -1.333 |
| A536 | 0.819 | -1.151 |
| A537 | 0.594 | -1.359 |
| A538 | 1.456 | -1.003 |
| A539 | 0.877 | -1.053 |
| A540 | 0.523 | -0.745 |
| A541 | 0.650 | -0.937 |
| A542 | 0.552 | -1.451 |
| A543 | 0.600 | -1.145 |
| A544 | 0.993 | -0.561 |
| A545 | 1.099 | -0.717 |
| A546 | 0.397 | 0.203 |
| A547 | 0.354 | -0.474 |
| A548 | 0.583 | -0.219 |

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-14, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

## TABLE 7-14

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$ .

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.978 | -1.779 |
| A602 | 1.011 | -2.091 |
| A603 | 0.781 | -1.333 |
| A604 | 0.819 | -1.151 |
| A605 | 0.594 | -1.359 |
| A606 | 1.456 | -1.003 |
| A607 | 0.877 | -1.053 |
| A608 | 0.523 | -0.745 |
| A609 | 0.650 | -0.937 |
| A610 | 0.552 | -1.451 |
| A611 | 0.600 | -1.145 |
| A612 | 0.993 | -0.561 |
| A613 | 1.099 | -0.717 |
| A614 | 0.397 | 0.203 |
| A615 | 0.354 | -0.474 |
| A616 | 0.583 | -0.219 |
| A617 | 1.147 | -1.532 |
| A618 | 0.588 | -1.193 |
| A619 | 0.696 | -1.180 |
| A620 | 1.051 | -0.629 |
| A621 | 1.016 | -0.960 |
| A622 | 0.724 | -1.614 |
| A623 | 0.529 | -1.441 |
| A624 | 0.701 | -2.068 |
| A625 | 0.470 | -1.764 |
| A626 | 0.602 | -1.024 |
| A627 | 0.388 | -0.492 |
| A628 | 0.279 | -2.600 |
| A629 | 0.752 | -0.655 |
| A630 | 0.736 | -1.017 |
| A631 | 0.684 | -0.853 |
| A632 | 0.744 | -1.407 |
| A633 | 0.460 | -1.157 |
| A634 | 1.363 | -1.595 |
| A635 | 1.090 | -2.065 |
| A636 | 0.828 | -1.576 |
| A637 | 0.556 | -1.107 |
| A638 | 0.525 | 0.646 |
| A639 | 0.064● | 10.800● |
| A640 | 0.618 | -0.211 |
| A641 | 0.724 | 0.056 |
| A642 | 0.758 | -1.267 |
| A643 | 0.843 | -0.872 |
| A644 | 1.322 | -0.489 |
| A645 | 0.561 | -0.315 |
| A646 | 0.573 | -0.792 |
| A647 | 0.618 | 0.296 |
| A648 | 1.007 | -1.675 |
| A649 | 0.508 | -0.793 |
| A650 | 0.629 | -0.393 |
| A651 | 0.711 | -0.959 |
| A652 | 0.314 | -1.062 |
| A653 | 0.627 | -0.768 |
| A654 | 0.280 | 1.884 |
| A655 | 0.988 | -0.470 |
| A656 | 0.575 | -1.370 |

__Note:__ The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-13, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

## TABLE 7-15

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.747 | -0.025 |
| J102 | 0.495 | -0.802 |
| J103 | 0.668 | -0.933 |
| J104 | 0.696 | -0.868 |
| J105 | 0.733 | -0.201 |
| J106 | 0.471 | -0.666 |
| J107 | 0.485 | -0.025 |
| J108 | 1.064 | -1.641 |
| J109 | 0.313 | -1.025 |
| J110 | 0.604 | -0.465 |
| J111 | 1.176 | -1.148 |
| J112 | 0.445 | -0.677 |
| J113 | 0.545 | -0.940 |
| J114 | 0.596 | 0.202 |
| J115 | 0.787 | -0.195 |
| J116 | 0.345 | -1.005 |
| J117 | 0.326 | -0.495 |
| J118 | 0.565 | -0.982 |
| J119 | 0.598 | -0.926 |
| J120 | 0.299 | 1.278 |
| J121 | 0.477 | -0.711 |
| J122 | 0.499 | -0.784 |
| J123 | 0.469 | 0.258 |
| J124 | 0.632 | -1.481 |
| J125 | 0.522 | -1.487 |
| J126 | 0.447 | -0.528 |
| J127 | 0.577 | -1.397 |
| J128 | 0.819 | -0.855 |
| J129 | 0.650 | 1.665 |
| J130 | 0.357 | -1.611 |
| J131 | 0.843 | -0.298 |
| J132 | 0.398 | 0.057 |
| J133 | 0.824 | -1.463 |
| J134 | 0.295 | 2.172 |
| J135 | 0.790 | -0.091 |
| J136 | 0.320 | 0.364 |
| J137 | 0.613 | 0.024 |
| J138 | 0.008● | 189.417● |
| J139 | 0.381 | 1.611 |
| J140 | 0.321 | 0.325 |
| J141 | 0.529 | -0.869 |
| J142 | 0.467 | 0.396 |
| J143 | 0.661 | -0.170 |
| J144 | 0.382 | -0.544 |
| J145 | 0.665 | -0.105 |
| J146 | 0.757 | -0.160 |
| J147 | 0.512 | 0.279 |
| J148 | 0.545 | 0.319 |
| J149 | 0.462 | -0.097 |
| J150 | 0.453 | 0.057 |
| J151 | 0.554 | 0.932 |
| J152 | 0.426 | 0.574 |
| J153 | 0.413 | 1.680 |
| J154 | 0.364 | 1.370 |
| J155 | 0.850 | 1.046 |
| J156 | 0.789 | 1.492 |

Note: The estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-16, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

## TABLE 7-16

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\theta$ Are the Same As Those of $\tau$ .

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.613 | 0.024 |
| J202 | 0.008● | 189.417● |
| J203 | 0.381 | 1.611 |
| J204 | 0.321 | 0.325 |
| J205 | 0.529 | -0.869 |
| J206 | 0.467 | 0.396 |
| J207 | 0.661 | -0.170 |
| J208 | 0.382 | -0.544 |
| J209 | 0.665 | -0.105 |
| J210 | 0.757 | -0.160 |
| J211 | 0.512 | 0.279 |
| J212 | 0.545 | 0.319 |
| J213 | 0.462 | -0.097 |
| J214 | 0.453 | 0.057 |
| J215 | 0.554 | 0.932 |
| J216 | 0.426 | 0.574 |
| J217 | 0.413 | 1.680 |
| J218 | 0.364 | 1.370 |
| J219 | 0.850 | 1.046 |
| J220 | 0.789 | 1.492 |
| J221 | 0.359 | 1.821 |
| J222 | 0.589 | 0.590 |
| J223 | 0.390 | -0.421 |
| J224 | 0.575 | 0.576 |
| J225 | 0.624 | -0.025 |
| J226 | 0.560 | 0.606 |
| J227 | 0.563 | 0.202 |
| J228 | 0.609 | -0.188 |
| J229 | 0.583 | 0.135 |
| J230 | 0.512 | 0.153 |
| J231 | 1.310 | 0.007 |
| J232 | 0.839 | -0.118 |
| J233 | 0.256 | 2.127 |
| J234 | 0.297 | 1.432 |
| J235 | 0.855 | 0.611 |
| J236 | 0.780 | 0.730 |
| J237 | 0.226 | -0.048 |
| J238 | 0.661 | 2.353 |
| J239 | 0.424 | 1.136 |
| J240 | 0.519 | 1.726 |
| J241 | 1.001 | 0.006 |
| J242 | 0.677 | 0.270 |
| J243 | 0.330 | 0.452 |
| J244 | 0.243 | 0.965 |
| J245 | 0.687 | 1.219 |
| J246 | 0.220 | 1.569 |
| J247 | 0.421 | 1.127 |
| J248 | 0.335 | -0.679 |
| J249 | 0.576 | 1.012 |
| J250 | 0.589 | 0.908 |
| J251 | 0.806 | 0.258 |
| J252 | 0.432 | 1.333 |
| J253 | 0.475 | 1.402 |
| J254 | 0.474 | 1.353 |
| J255 | 0.908 | 1.431 |
| J256 | 0.422 | 2.041 |
| J257 | 0.441 | 1.022 |
| J258 | 0.340 | 1.535 |
| J259 | 0.649 | 1.632 |
| J260 | 0.097● | 2.936 |

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-15, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-17

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$ .

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.743 | -2.579 |
| A502 | 0.517 | -3.672● |
| A503 | 0.590 | -3.824● |
| A504 | 0.622 | -2.302 |
| A505 | 0.787 | -2.672 |
| A506 | 0.465 | -2.285 |
| A507 | 0.496 | -1.061 |
| A508 | 0.767 | -2.061 |
| A509 | 1.425 | -2.186 |
| A510 | 0.641 | -1.047 |
| A511 | 0.481 | -2.426 |
| A512 | 0.686 | -2.153 |
| A513 | 1.025 | -3.093● |
| A514 | 0.895 | -2.096 |
| A515 | 0.475 | -2.561 |
| A516 | 0.423 | 0.577 |
| A517 | 1.757 | -2.607 |
| A518 | 0.372 | -2.778 |
| A519 | 0.702 | -2.193 |
| A520 | 0.364 | -3.501● |
| A521 | 0.639 | -2.163 |
| A522 | 0.406 | -0.710 |
| A523 | 0.082● | 5.379● |
| A524 | 0.435 | -2.297 |
| A525 | 1.001 | -2.233 |
| A526 | 0.877 | -0.920 |
| A527 | 0.089● | -0.428 |
| A528 | 0.424 | -0.078 |
| A529 | 0.534 | -0.616 |
| A530 | 0.623 | -1.954 |
| A531 | 0.026● | 47.687● |
| A532 | 0.510 | 0.071 |
| A533 | 0.800 | -2.018 |
| A534 | 0.828 | -2.398 |
| A535 | 0.641 | -1.472 |
| A536 | 0.677 | -1.248 |
| A537 | 0.488 | -1.503 |
| A538 | 1.192 | -1.067 |
| A539 | 0.720 | -1.130 |
| A540 | 0.431 | -0.757 |
| A541 | 0.539 | -0.988 |
| A542 | 0.456 | -1.613 |
| A543 | 0.496 | -1.241 |
| A544 | 0.816 | -0.531 |
| A545 | 0.903 | -0.720 |
| A546 | 0.326 | 0.396 |
| A547 | 0.292 | -0.429 |
| A548 | 0.482 | -0.120 |

**Note:** The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-18, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2.

## TABLE 7-18

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.800 | -2.018 |
| A602 | 0.828 | -2.398 |
| A603 | 0.641 | -1.472 |
| A604 | 0.677 | -1.248 |
| A605 | 0.488 | -1.503 |
| A606 | 1.192 | -1.067 |
| A607 | 0.720 | -1.130 |
| A608 | 0.431 | -0.757 |
| A609 | 0.539 | -0.988 |
| A610 | 0.456 | -1.613 |
| A611 | 0.496 | -1.241 |
| A612 | 0.816 | -0.531 |
| A613 | 0.903 | -0.720 |
| A614 | 0.326 | 0.396 |
| A615 | 0.292 | -0.429 |
| A616 | 0.482 | -0.120 |
| A617 | 0.972 | -1.683 |
| A618 | 0.491 | -1.293 |
| A619 | 0.591 | -1.266 |
| A620 | 0.903 | -0.615 |
| A621 | 0.848 | -1.011 |
| A622 | 0.609 | -1.787 |
| A623 | 0.446 | -1.581 |
| A624 | 0.592 | -2.319 |
| A625 | 0.398 | -1.960 |
| A626 | 0.509 | -1.084 |
| A627 | 0.330 | -0.456 |
| A628 | 0.236 | -2.945 |
| A629 | 0.629 | -0.650 |
| A630 | 0.624 | -1.075 |
| A631 | 0.579 | -0.881 |
| A632 | 0.630 | -1.535 |
| A633 | 0.390 | -1.242 |
| A634 | 1.146 | -1.762 |
| A635 | 0.923 | -2.313 |
| A636 | 0.698 | -1.739 |
| A637 | 0.470 | -1.183 |
| A638 | 0.446 | 0.881 |
| A639 | 0.058● | 12.140● |
| A640 | 0.518 | -0.122 |
| A641 | 0.754 | 0.049 |
| A642 | 0.482 | -1.007 |
| A643 | 0.707 | -0.850 |
| A644 | 0.876 | -0.595 |
| A645 | 0.665 | -0.206 |
| A646 | 0.481 | -0.661 |
| A647 | 0.551 | 0.149 |
| A648 | 0.984 | -1.664 |
| A649 | 0.362 | -0.839 |
| A650 | 0.615 | -0.385 |
| A651 | 0.981 | -1.057 |
| A652 | 0.395 | -0.775 |
| A653 | 0.577 | -0.810 |
| A654 | 0.550 | 0.421 |
| A655 | 0.799 | -0.220 |
| A656 | 0.347 | -1.205 |

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-17, respectively since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2. Also The estimated item parameters for items A641 through A656 are the same as those for J101 through J116 in Table 7-19, respectively, since they are overlapping items between Tests A6 and J1.

## TABLE 7-19

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$ .**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.754 | 0.049 |
| J102 | 0.482 | -1.007 |
| J103 | 0.707 | -0.850 |
| J104 | 0.876 | -0.595 |
| J105 | 0.665 | -0.206 |
| J106 | 0.481 | -0.661 |
| J107 | 0.551 | 0.149 |
| J108 | 0.984 | -1.664 |
| J109 | 0.362 | -0.839 |
| J110 | 0.615 | -0.385 |
| J111 | 0.981 | -1.057 |
| J112 | 0.395 | -0.775 |
| J113 | 0.577 | -0.810 |
| J114 | 0.550 | 0.421 |
| J115 | 0.799 | -0.220 |
| J116 | 0.347 | -1.205 |
| J117 | 0.349 | -0.406 |
| J118 | 0.606 | -0.861 |
| J119 | 0.643 | -0.807 |
| J120 | 0.319 | 1.250 |
| J121 | 0.512 | -0.606 |
| J122 | 0.534 | -0.677 |
| J123 | 0.505 | 0.296 |
| J124 | 0.678 | -1.325 |
| J125 | 0.561 | -1.329 |
| J126 | 0.480 | -0.437 |
| J127 | 0.619 | -1.246 |
| J128 | 0.877 | -0.743 |
| J129 | 0.698 | 1.607 |
| J130 | 0.382 | -1.451 |
| J131 | 0.903 | -0.222 |
| J132 | 0.426 | 0.108 |
| J133 | 0.880 | -1.314 |
| J134 | 0.317 | 2.079 |
| J135 | 0.848 | -0.028 |
| J136 | 0.343 | 0.396 |
| J137 | 0.659 | 0.077 |
| J138 | 0.007 ● | 199.696 ● |
| J139 | 0.410 | 1.551 |
| J140 | 0.345 | 0.356 |
| J141 | 0.569 | -0.753 |
| J142 | 0.502 | 0.423 |
| J143 | 0.711 | -0.103 |
| J144 | 0.412 | -0.450 |
| J145 | 0.716 | -0.042 |
| J146 | 0.817 | -0.092 |
| J147 | 0.550 | 0.314 |
| J148 | 0.586 | 0.352 |
| J149 | 0.498 | -0.033 |
| J150 | 0.488 | 0.108 |
| J151 | 0.596 | 0.921 |
| J152 | 0.459 | 0.588 |
| J153 | 0.445 | 1.614 |
| J154 | 0.392 | 1.328 |
| J155 | 0.916 | 1.028 |
| J156 | 0.853 | 1.440 |

**Note:** The estimated item parameters for items J101 through J116 are the same as those for items A641 through A656 in Table 7-18, respectively, since they are overlapping items between Tests A6 and J1 and the results are of Case A5-A6-J1-J2. Also the estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-20, respectively, since they are overlapping items between Tests J1 and J2.

## TABLE 7-20

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0699, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.659 | 0.077 |
| J202 | 0.007● | 199.696● |
| J203 | 0.410 | 1.551 |
| J204 | 0.345 | 0.356 |
| J205 | 0.569 | -0.753 |
| J206 | 0.502 | 0.423 |
| J207 | 0.711 | -0.103 |
| J208 | 0.412 | -0.450 |
| J209 | 0.716 | -0.042 |
| J210 | 0.817 | -0.092 |
| J211 | 0.550 | 0.314 |
| J212 | 0.586 | 0.352 |
| J213 | 0.498 | -0.033 |
| J214 | 0.488 | 0.108 |
| J215 | 0.596 | 0.921 |
| J216 | 0.459 | 0.588 |
| J217 | 0.445 | 1.614 |
| J218 | 0.392 | 1.328 |
| J219 | 0.916 | 1.028 |
| J220 | 0.853 | 1.440 |
| J221 | 0.388 | 1.741 |
| J222 | 0.635 | 0.602 |
| J223 | 0.422 | -0.332 |
| J224 | 0.622 | 0.590 |
| J225 | 0.676 | 0.036 |
| J226 | 0.607 | 0.618 |
| J227 | 0.608 | 0.243 |
| J228 | 0.659 | -0.117 |
| J229 | 0.631 | 0.183 |
| J230 | 0.553 | 0.198 |
| J231 | 1.416 | 0.064 |
| J232 | 0.908 | -0.052 |
| J233 | 0.277 | 2.023 |
| J234 | 0.322 | 1.381 |
| J235 | 0.926 | 0.622 |
| J236 | 0.842 | 0.732 |
| J237 | 0.245 | 0.016 |
| J238 | 0.714 | 2.234 |
| J239 | 0.457 | 1.108 |
| J240 | 0.560 | 1.653 |
| J241 | 1.086 | 0.065 |
| J242 | 0.731 | 0.307 |
| J243 | 0.356 | 0.473 |
| J244 | 0.262 | 0.949 |
| J245 | 0.742 | 1.184 |
| J246 | 0.237 | 1.509 |
| J247 | 0.455 | 1.100 |
| J248 | 0.362 | -0.572 |
| J249 | 0.620 | 0.993 |
| J250 | 0.637 | 0.897 |
| J251 | 0.872 | 0.296 |
| J252 | 0.468 | 1.290 |
| J253 | 0.514 | 1.354 |
| J254 | 0.513 | 1.309 |
| J255 | 0.980 | 1.381 |
| J256 | 0.456 | 1.945 |
| J257 | 0.477 | 1.002 |
| J258 | 0.368 | 1.477 |
| J259 | 0.701 | 1.566 |
| J260 | 0.103 | 2.789 |

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-19, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case A5-A6-J1-J2.

TABLE 7-21

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$ .

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.773 | -0.051 |
| J102 | 0.514 | -0.796 |
| J103 | 0.695 | -0.923 |
| J104 | 0.723 | -0.860 |
| J105 | 0.764 | -0.218 |
| J106 | 0.491 | -0.664 |
| J107 | 0.505 | -0.048 |
| J108 | 1.114 | -1.596 |
| J109 | 0.327 | -1.004 |
| J110 | 0.634 | -0.468 |
| J111 | 1.228 | -1.127 |
| J112 | 0.460 | -0.679 |
| J113 | 0.564 | -0.933 |
| J114 | 0.619 | 0.170 |
| J115 | 0.822 | -0.212 |
| J116 | 0.357 | -0.997 |
| J117 | 0.339 | -0.501 |
| J118 | 0.585 | -0.974 |
| J119 | 0.621 | -0.917 |
| J120 | 0.310 | 1.208 |
| J121 | 0.498 | -0.705 |
| J122 | 0.519 | -0.779 |
| J123 | 0.488 | 0.224 |
| J124 | 0.659 | -1.446 |
| J125 | 0.546 | -1.448 |
| J126 | 0.465 | -0.532 |
| J127 | 0.599 | -1.369 |
| J128 | 0.854 | -0.847 |
| J129 | 0.674 | 1.581 |
| J130 | 0.373 | -1.567 |
| J131 | 0.879 | -0.312 |
| J132 | 0.412 | 0.030 |
| J133 | 0.868 | -1.420 |
| J134 | 0.303 | 2.084 |
| J135 | 0.824 | -0.113 |
| J136 | 0.333 | 0.327 |
| J137 | 0.638 | 0.098 |
| J138 | --- | --- |
| J139 | 0.418 | 1.315 |
| J140 | 0.386 | 0.273 |
| J141 | 0.592 | -0.830 |
| J142 | 0.465 | 0.402 |
| J143 | 0.687 | -0.182 |
| J144 | 0.364 | -0.468 |
| J145 | 0.754 | -0.262 |
| J146 | 0.840 | -0.067 |
| J147 | 0.458 | 0.272 |
| J148 | 0.492 | 0.408 |
| J149 | 0.494 | -0.189 |
| J150 | 0.488 | -0.077 |
| J151 | 0.452 | 0.952 |
| J152 | 0.358 | 0.611 |
| J153 | 0.462 | 1.476 |
| J154 | 0.228 | 2.044 |
| J155 | 0.845 | 1.043 |
| J156 | 0.723 | 1.427 |

## TABLE 7-22

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ | $\hat{c}_g$ |
|---|---|---|---|
| J101 | 1.013 | 0.293 | 0.146 |
| J102 | 0.540 | -0.483 | 0.143 |
| J103 | 0.722 | -0.663 | 0.143 |
| J104 | 0.784 | -0.579 | 0.143 |
| J105 | 0.949 | 0.105 | 0.137 |
| J106 | 0.550 | -0.271 | 0.143 |
| J107 | 0.623 | 0.346 | 0.143 |
| J108 | 0.930 | -1.734 | 0.143 |
| J109 | 0.351 | -0.504 | 0.143 |
| J110 | 0.717 | -0.130 | 0.143 |
| J111 | 1.181 | -1.022 | 0.143 |
| J112 | 0.494 | -0.302 | 0.143 |
| J113 | 0.582 | -0.646 | 0.143 |
| J114 | 1.180 | 0.734 | 0.234 |
| J115 | 1.088 | 0.178 | 0.173 |
| J116 | 0.387 | -0.533 | 0.143 |
| J117 | 0.377 | 0.019 | 0.143 |
| J118 | 0.588 | -0.711 | 0.143 |
| J119 | 0.649 | -0.640 | 0.143 |
| J120 | 1.107 | 1.714 | 0.278 |
| J121 | 0.536 | -0.345 | 0.143 |
| J122 | 0.552 | -0.438 | 0.143 |
| J123 | 0.640 | 0.625 | 0.143 |
| J124 | 0.624 | -1.324 | 0.143 |
| J125 | 0.537 | -1.255 | 0.143 |
| J126 | 0.522 | -0.122 | 0.143 |
| J127 | 0.583 | -1.199 | 0.143 |
| J128 | 0.886 | -0.619 | 0.143 |
| J129 | 0.827 | 1.496 | 0.018 |
| J130 | 0.370 | -1.240 | 0.143 |
| J131 | 1.218 | 0.105 | 0.191 |
| J132 | 0.509 | 0.497 | 0.143 |
| J133 | 0.835 | -1.316 | 0.143 |
| J134 | 0.645 | 2.154 | 0.162 |
| J135 | 0.847 | -0.003 | 0.041 |
| J136 | 0.416 | 0.848 | 0.143 |
| J137 | 0.824 | 0.429 | 0.131 |
| J138 | --- | --- | --- |
| J139 | 1.225 | 1.590 | 0.213 |
| J140 | 0.606 | 0.965 | 0.218 |
| J141 | 0.612 | -0.543 | 0.143 |
| J142 | 0.940 | 1.035 | 0.245 |
| J143 | 1.012 | 0.306 | 0.201 |
| J144 | 0.414 | 0.028 | 0.143 |
| J145 | 0.829 | -0.026 | 0.103 |
| J146 | 0.966 | 0.145 | 0.087 |
| J147 | 1.586 | 1.135 | 0.338 |
| J148 | 0.821 | 0.954 | 0.207 |
| J149 | 0.587 | 0.218 | 0.143 |
| J150 | 0.577 | 0.332 | 0.143 |
| J151 | 0.816 | 1.354 | 0.181 |
| J152 | 1.277 | 1.470 | 0.331 |
| J153 | 1.148 | 1.607 | 0.167 |
| J154 | 0.702 | 2.350 | 0.249 |
| J155 | 1.623 | 1.126 | 0.089 |
| J156 | 1.462 | 1.409 | 0.086 |

TABLE 7-23

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.764 | -0.219 |
| J102 | 0.549 | -0.908 |
| J103 | 0.622 | -1.146 |
| J104 | 0.769 | -0.748 |
| J105 | 0.848 | -0.085 |
| J106 | 0.513 | -0.686 |
| J107 | 0.589 | 0.211 |
| J108 | 0.978 | -1.708 |
| J109 | 0.386 | -0.824 |
| J110 | 0.591 | -0.302 |
| J111 | 1.155 | -1.140 |
| J112 | 0.439 | -0.999 |
| J113 | 0.528 | -1.003 |
| J114 | 0.488 | 0.471 |
| J115 | 0.746 | -0.212 |
| J116 | 0.303 | -1.598 |
| J117 | 0.397 | -0.574 |
| J118 | 0.660 | -1.413 |
| J119 | 0.704 | -0.904 |
| J120 | 0.293 | 1.015 |
| J121 | 0.502 | -0.811 |
| J122 | 0.472 | -0.961 |
| J123 | 0.461 | 0.150 |
| J124 | 0.621 | -1.183 |
| J125 | 0.489 | -1.527 |
| J126 | 0.375 | -0.375 |
| J127 | 0.574 | -1.180 |
| J128 | 0.757 | -1.002 |
| J129 | 0.757 | 1.434 |
| J130 | 0.389 | -1.605 |
| J131 | 0.862 | -0.465 |
| J132 | 0.332 | 0.186 |
| J133 | 0.960 | -1.245 |
| J134 | 0.298 | 1.581 |
| J135 | 0.917 | -0.212 |
| J136 | 0.362 | 0.280 |
| J137 | 0.606 | 0.320 |
| J138 | --- | --- |
| J139 | 0.397 | 1.484 |
| J140 | 0.415 | 0.219 |
| J141 | 0.583 | -0.658 |
| J142 | 0.463 | 0.136 |
| J143 | 0.617 | -0.087 |
| J144 | 0.376 | -0.397 |
| J145 | 0.651 | -0.464 |
| J146 | 0.928 | 0.049 |
| J147 | 0.362 | 0.363 |
| J148 | 0.521 | -0.063 |
| J149 | 0.500 | -0.102 |
| J150 | 0.537 | -0.032 |
| J151 | 0.470 | 0.857 |
| J152 | 0.400 | 0.447 |
| J153 | 0.432 | 1.833 |
| J154 | 0.254 | 2.132 |
| J155 | 0.792 | 1.218 |
| J156 | 0.738 | 1.381 |

## TABLE 7-24

**Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of $\theta$ .**

| Item | $\hat{a}_g$ | $\hat{b}_g$ | $\hat{c}_g$ |
|---|---|---|---|
| J101 | 0.949 | 0.098 | 0.151 |
| J102 | 0.571 | -0.637 | 0.146 |
| J103 | 0.639 | -0.913 | 0.146 |
| J104 | 0.842 | -0.493 | 0.146 |
| J105 | 1.026 | 0.139 | 0.109 |
| J106 | 0.565 | -0.337 | 0.146 |
| J107 | 0.726 | 0.466 | 0.109 |
| J108 | 0.849 | -1.821 | 0.146 |
| J109 | 0.421 | -0.393 | 0.146 |
| J110 | 0.706 | 0.053 | 0.146 |
| J111 | 1.114 | -1.059 | 0.146 |
| J112 | 0.457 | -0.660 | 0.146 |
| J113 | 0.551 | -0.712 | 0.146 |
| J114 | 0.996 | 1.044 | 0.245 |
| J115 | 0.946 | 0.154 | 0.172 |
| J116 | 0.321 | -1.102 | 0.146 |
| J117 | 0.441 | -0.135 | 0.146 |
| J118 | 0.629 | -1.300 | 0.146 |
| J119 | 0.743 | -0.662 | 0.146 |
| J120 | 0.566 | 1.667 | 0.229 |
| J121 | 0.531 | -0.490 | 0.146 |
| J122 | 0.492 | -0.636 | 0.146 |
| J123 | 0.577 | 0.554 | 0.146 |
| J124 | 0.620 | -0.977 | 0.146 |
| J125 | 0.487 | -1.307 | 0.146 |
| J126 | 0.430 | 0.102 | 0.146 |
| J127 | 0.575 | -0.968 | 0.146 |
| J128 | 0.765 | -0.818 | 0.146 |
| J129 | 0.877 | 1.367 | 0.013 |
| J130 | 0.385 | -1.316 | 0.146 |
| J131 | 1.054 | -0.127 | 0.178 |
| J132 | 0.409 | 0.713 | 0.146 |
| J133 | 0.960 | -1.119 | 0.146 |
| J134 | 0.456 | 1.928 | 0.146 |
| J135 | 1.003 | -0.051 | 0.085 |
| J136 | 0.456 | 0.758 | 0.146 |
| J137 | 0.762 | 0.566 | 0.108 |
| J138 | --- | --- | --- |
| J139 | 0.997 | 1.661 | 0.193 |
| J140 | 0.527 | 0.656 | 0.146 |
| J141 | 0.623 | -0.357 | 0.146 |
| J142 | 0.847 | 0.857 | 0.267 |
| J143 | 0.908 | 0.410 | 0.209 |
| J144 | 0.422 | 0.067 | 0.146 |
| J145 | 0.721 | -0.164 | 0.146 |
| J146 | 1.144 | 0.253 | 0.101 |
| J147 | 1.558 | 1.328 | 0.373 |
| J148 | 0.632 | 0.316 | 0.146 |
| J149 | 0.594 | 0.280 | 0.146 |
| J150 | 0.654 | 0.338 | 0.146 |
| J151 | 0.810 | 1.247 | 0.182 |
| J152 | 1.018 | 1.252 | 0.308 |
| J153 | 1.311 | 1.682 | 0.156 |
| J154 | 0.671 | 2.256 | 0.212 |
| J155 | 1.492 | 1.223 | 0.085 |
| J156 | 1.575 | 1.346 | 0.095 |

standard deviation of each, separate distribution of $\hat{\theta}$ , respectively.

Close observation of the first and third graph of Figure 7-7 suggests that this assumption of equality of the mean and standard deviation of the distribution of $\theta$ and those of the distribution of in each examinee group may not be appropriate. We can see in these two graphs that those item parameter estimates obtained by Logist 5 assuming (two-parameter) logistic model tend to be higher in discrimination indices and tend to be regressed to center in difficulty indices compared with the corresponding estimates obtained by the Tetrachoric Method. This fact suggests that the distribution of $\hat{\theta}$ obtained by Logist 5 has a larger standard deviation than that of $\theta$ for these two examinee groups.

If the assumption that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ equal those of the distribution of $\theta$ in each combined examinee group, then the line specified by

$$(7.1) \qquad \hat{\sigma}_u \, \hat{a}_{(L)} = \hat{\sigma}_c \, \hat{a}_{(T)} ,$$

where $\hat{\sigma}_c$ and $\hat{\sigma}_u$ are the estimated standard deviations of the distribution of $\theta$ of a specified combined group and of an uncombined group which is a part of the combined group, respectively, and $\hat{a}_{(T)}$ and $\hat{a}_{(L)}$ represent the axes of estimated item discrimination parameters by Tetrachoric Method and by Logist 5 , respectively, will fit the corresponding scatter diagram of the two sets of unadjusted estimated discrimination parameters. The corresponding formula for the scatter diagram of the two sets of estimated difficulty parameters before any scale adjustment is

$$(7.2) \qquad \hat{\sigma}_c \hat{b}_{(L)} + \hat{\mu}_c = \hat{\sigma}_u \hat{b}_{(T)} + \hat{\mu}_u ,$$

where $\hat{\sigma}_c$ and $\hat{\sigma}_u$ are as described earlier, $\hat{\mu}_c$ and $\hat{\mu}_u$ are the estimated means of the combined group and of the uncombined group, respectively, and $\hat{b}_{(T)}$ and $\hat{b}_{(L)}$ represent the axes of estimated item difficulty parameters by Tetrachoric Method and by Logist 5, respectively.

The linear relationship specified by (7.1) for the estimated discrimination parameters is drawn by a long dashed line in each graph of Figure 7-1, which includes the two combined groups, i.e., Cases A5-A6 and J1-J2. We can see that the line does not fit to the scatter diagram very well in each of the first three graphs of Figure 7-1, while it does a little better in the other two. The corresponding linear relationship specified by (7.2) for the estimated difficulty parameters is also shown by a long dashed line in each graph of Figure 7-2. The fit of these lines to the corresponding scatter diagrams appears to be fairly good this time, but not to the extent to make us feel unnecessary to search for better linear relationships for these scatter diagrams of estimated difficulty parameters.

Corresponding two sets of linear relationships for the scatter diagrams of the "unadjusted" item discrimination and difficulty parameters were obtained with respect to Case A5-A6-J1-J2 by using formulae (7.1) and (7.2), and they are shown by long dashed lines in Figures 7-3 and 7-4. We can see that, in these cases, too, the linear relationships do not fit the corresponding scatter diagrams very well.

The same procedure was taken for each of the scatter diagrams of the estimated item discrimination parameters, and of the estimated difficulty parameters, which concern with Case J1/1075: $c_g$-Zero and with Case J1/2259: $c_g$-Zero. These resulting linear relationships are drawn by long dashed lines in the corresponding graphs of Figures 7-5 and 7-6. In these results, there is a systematic tendency that for the scatter diagrams of estimated item discrimination parameters these long dashed lines are too steep, and for those of estimated item difficulty parameters the lines are too flat. This fact indicates that both standard deviations of the distribution of $\hat{\theta}$ in Case J1/1075: $c_g$-Zero and in Case J1/2259: $c_g$-Zero are larger than the standard deviations of the corresponding distributions of $\theta$ . Note that this finding is consistent with the observation made earlier for the first and the third graphs of Figure 7-7. For comparison, the same linear relationship obtained for $c_g$-Zero is also shown by a long dashed line in the corresponding graph for $c_g$-Free for each of Cases J1/1075 and J1/2259. We can see that these lines are much farther apart from the corresponding scatter diagrams.

Since the linear relationships specified by (7.1) and (7.2) failed in fitting the corresponding scatter diagrams in many cases, the iterative method of finding the best fitted lines for both the estimated item discrimination and difficulty parameters, which was introduced and applied for the overlapping test items in Section 6, was also adopted for the present results. Table 7-25 presents the slope and intercept of each of the resulting linear relationships. As before, certain items were excluded in the process of obtaining the best fitted linear relationships since one, or both, of the two estimated difficulty parameters exceeds 2.0 in absolute value. There are 5 items of Test A5 excluded from the first scatter diagrams of Figures 7-1 and 7-2, 6 items of Test A6 from the second scatter diagrams of these two figures, 2 items of Test J1 from the third ones, 4 items of Test J1 from the fourth ones, and 2 items of Test J2 from the fifth ones; there are 9 items of Test A5 excluded from the first scatter diagrams of Figures 7-3 and 7-4, 6 items of Test A6 from the second scatter diagrams of these two figures, 4 items of Test J1 from the third ones, and 2 items of Test J2 from the fourth ones; and there is 1 item of Test J1 excluded from the first scatter diagrams of Figures 7-5 and 7-6, 4 items of Test J1 from the third scatter diagrams of these two figures, 3 items of Test J1 from the fifth ones, and 4 items of Test J1 from the seventh ones. These items are circled in the scatter diagrams of Figures 7-1 through 7-6, unless they are not seen in these figures because of their too extremely deviated estimate values. The linear relationship thus obtained is drawn by a thin, solid line in each graph of Figures 7-1 through 7-4, and in each graph of Figures 7-5 and 7-6 where (two-parameter) logistic model is

## TABLE 7-25

**Slope And Intercept of Each of the Fitted Linear Relationship between the Two Sets of Estimated Discrimination Parameters, And Also Those of Estimated Difficulty Parameters, of the Common Test Items, Which Were Obtained by the Tetrachoric Method (Examinee Group 1) And by Logist 5 (Examinee Group 2), before Any Scale Adjustment.**

| Examinee Group 1 | Examinee Group 2 | $a_g$ | | Combined | $b_g$ | | Combined | |
|---|---|---|---|---|---|---|---|---|
| | | Slope | Intercept | Slope | Slope | Intercept | Slope | Intercept |
| A5/0599 | A5-A6 | 1.222 | -0.013 | 1.214 | 0.829 | -0.267 | 0.823 | -0.270 |
| A6/0412 | A5-A6 | 1.034 | -0.008 | 1.048 | 0.941 | 0.331 | 0.954 | 0.338 |
| J1/0614 | A5-A6 | 1.012* | -0.018* | 0.897* | 1.257* | 0.937* | 1.115* | 0.841* |
| J1/0614 | J1-J2 | 1.339 | -0.009 | 1.377 | 0.707 | -0.572 | 0.726 | -0.566 |
| J2/0758 | J1-J2 | 1.083 | -0.012 | 1.121 | 0.861 | 0.446 | 0.892 | 0.462 |
| A5/0599 | A5-A6-J1-J2 | 1.567 | -0.018 | 1.555 | 0.648 | -0.921 | 0.643 | -0.923 |
| A6/0412 | A5-A6-J1-J2 | 1.387 | -0.009 | 1.427 | 0.681 | -0.470 | 0.701 | -0.458 |
| J1/0614 | A5-A6-J1-J2 | 1.479 | -0.006 | 1.522 | 0.638 | -0.118 | 0.657 | -0.112 |
| J2/0758 | A5-A6-J1-J2 | 1.234 | -0.014 | 1.277 | 0.757 | 0.783 | 0.783 | 0.796 |
| J1/1075 | J1/1075 | 1.102 | -0.006 | 1.107 | 0.899 | -0.015 | 0.903 | -0.013 |
| J1/0614 | J1/1075 | 1.162 | -0.009 | 1.202 | 0.804 | -0.256 | 0.832 | -0.247 |
| J1/2259 | J1/2259 | 1.068 | -0.005 | 1.069 | 0.935 | -0.007 | 0.936 | -0.007 |
| J1/0614 | J1/2259 | 1.069 | -0.00[illegible] | 1.081 | 0.915 | -0.284 | 0.925 | -0.281 |

* This is based on only 14 items while all the other results are based on at least 36 items.

assumed in using Logist 5. As before, the two sets of results obtained for the scatter diagram of the estimated item discrimination parameters and for that of the estimated item difficulty parameters were combined in each case, and the result is shown by a thick, solid line in each graph. Again, in the last two figures, for comparison, the same pair of solid lines are drawn in each corresponding graph for the results of the three-parameter logistic model.

## VIII. Scale Adjustment II

For the purpose of better visualizing the discrepancies in the mean and standard deviation between the distribution of $\theta$ and that of $\hat{\theta}$ for each examinee group, the rescaled item parameters of the items of Tests A5, A6, J1 and J2, which were obtained originally by Logist 5 and shown in Tables 7-13 through 7-24, were plotted against the corresponding rescaled item parameters obtained originally by Tetrachoric Method, which are shown in Tables 6-4 through 6-9. They were paired, arranged and categorized in the same way as we did for the unadjusted parameter estimates in Figures 7-1 through 7-6, and presented as Figures 8-1 through 8-6. We notice that, if the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of $\theta$ in each examinee group, then the line passing through the origin, (0,0) , and converging the abscissa with the angle of 45 degrees will be the best fitting linear relationship in each graph of these figures, except for the situations which concern three-parameter logistic model assumed in using Logist 5 .

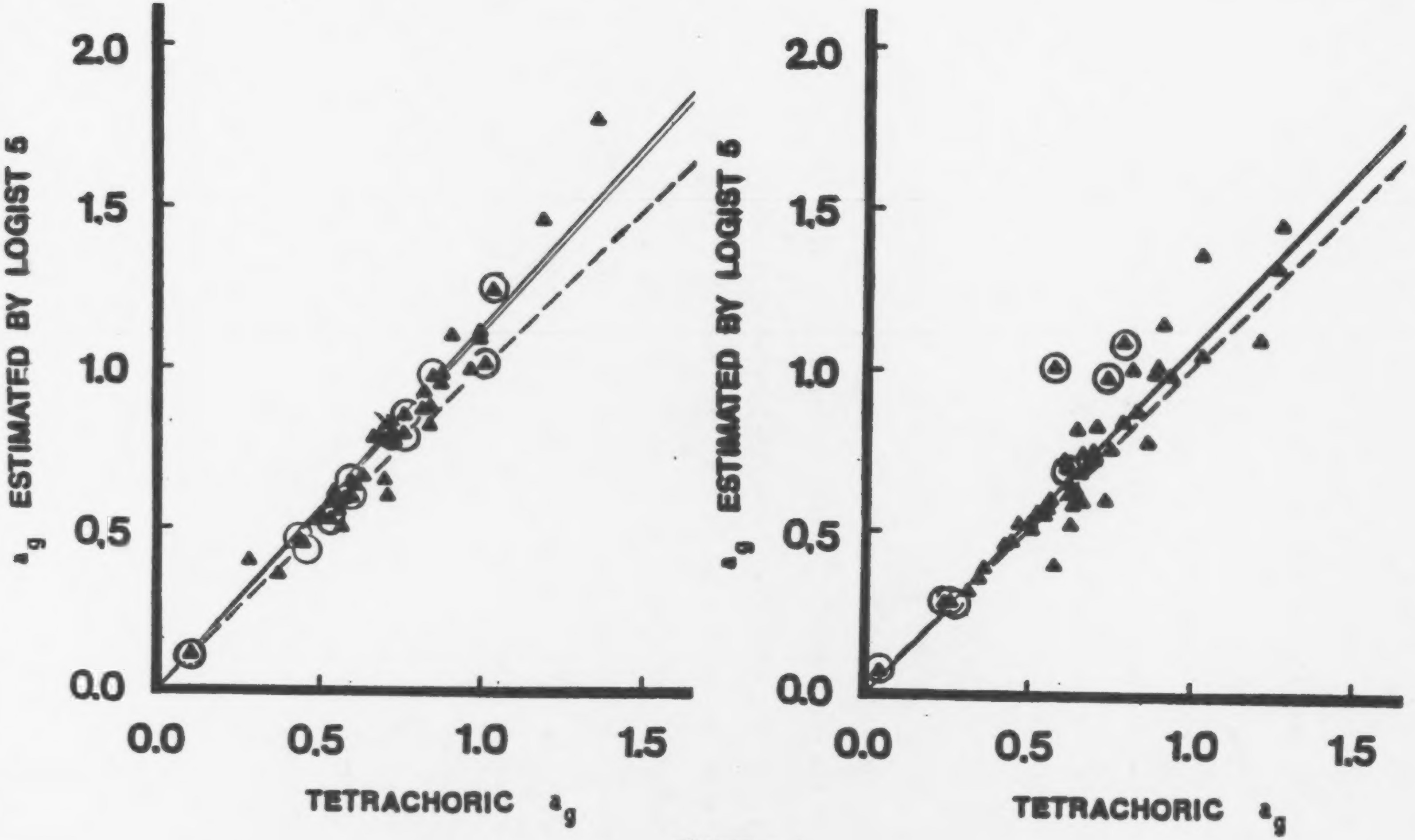

FIGURE 8-1

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa and upon the Case A5-A6 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

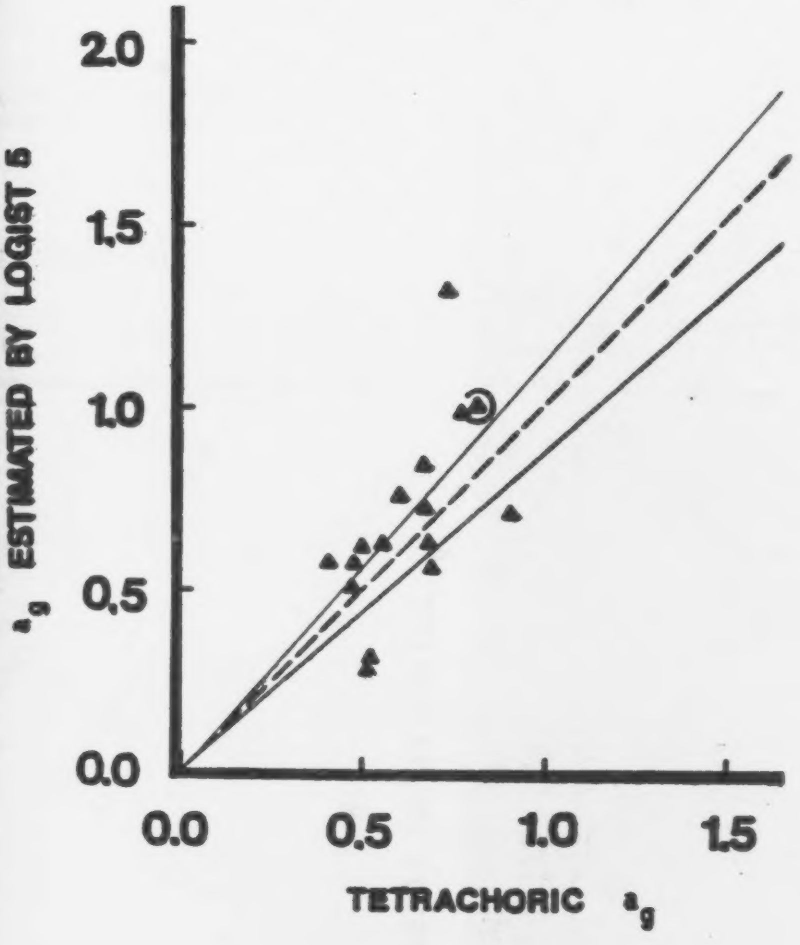

FIGURE 8-1 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

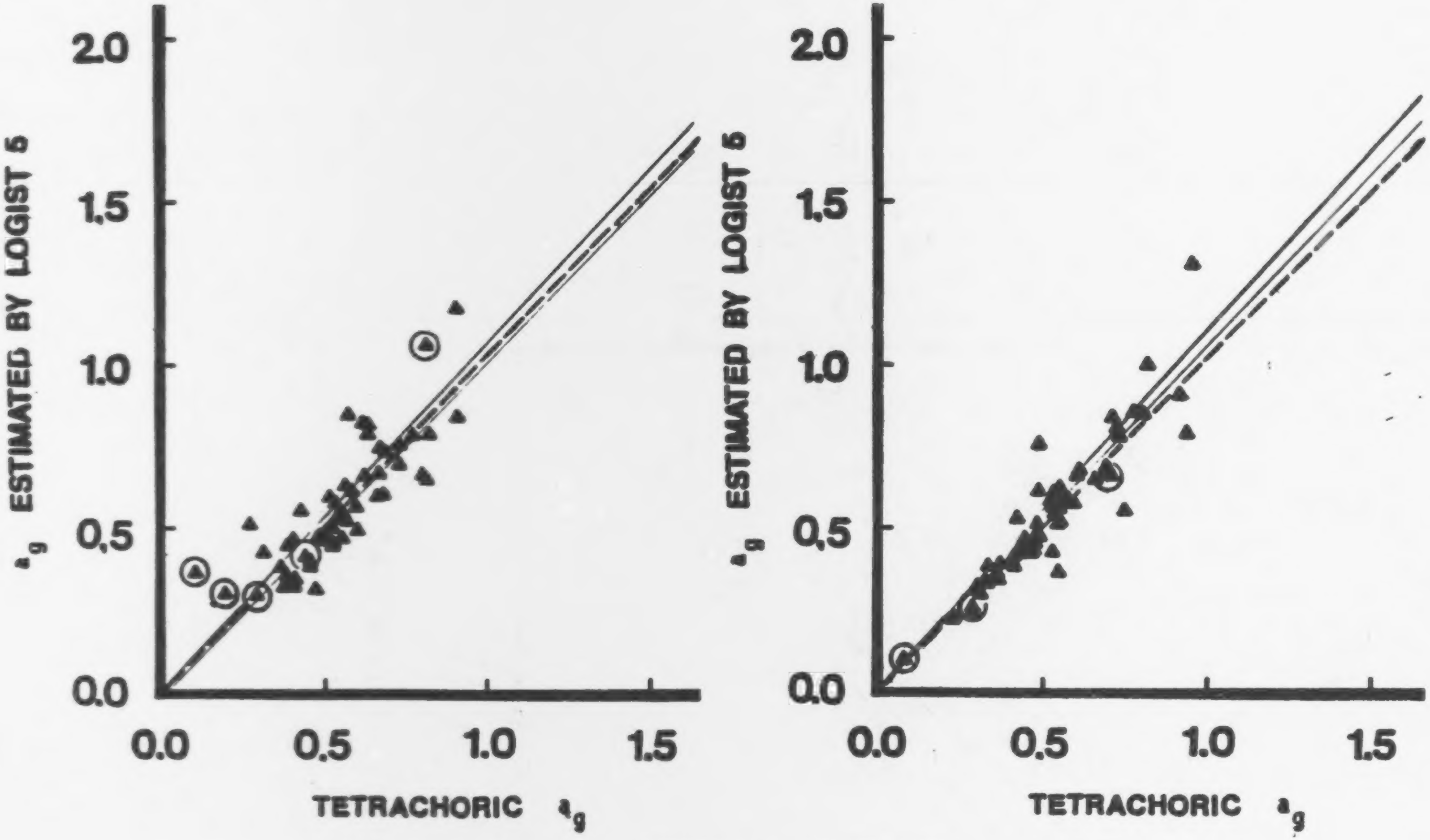

FIGURE 8-1 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

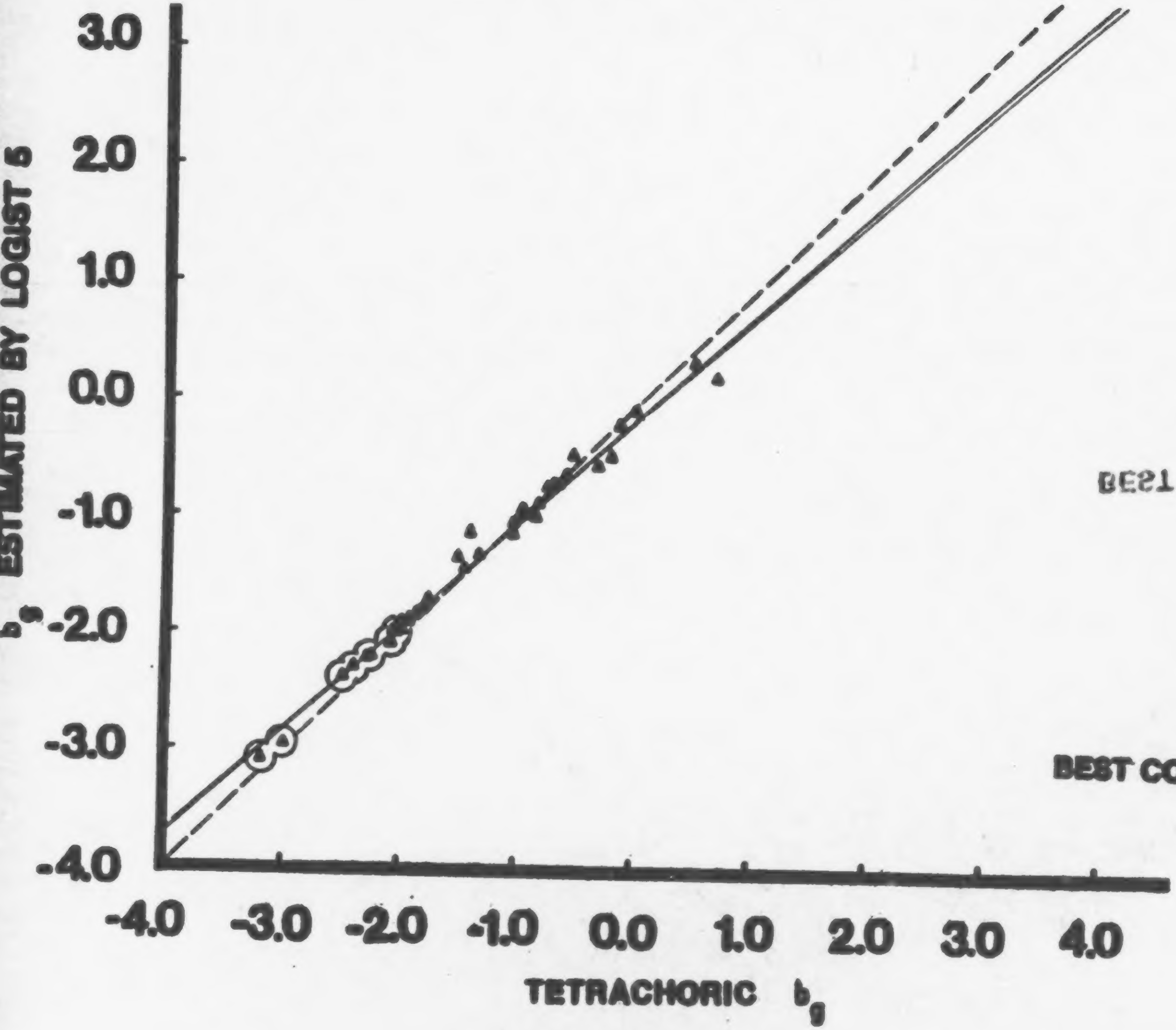

FIGURE 8-2

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5 , Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Solid, Thin Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. For the 43 Items of Test A5 Excluding Items A523 And A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

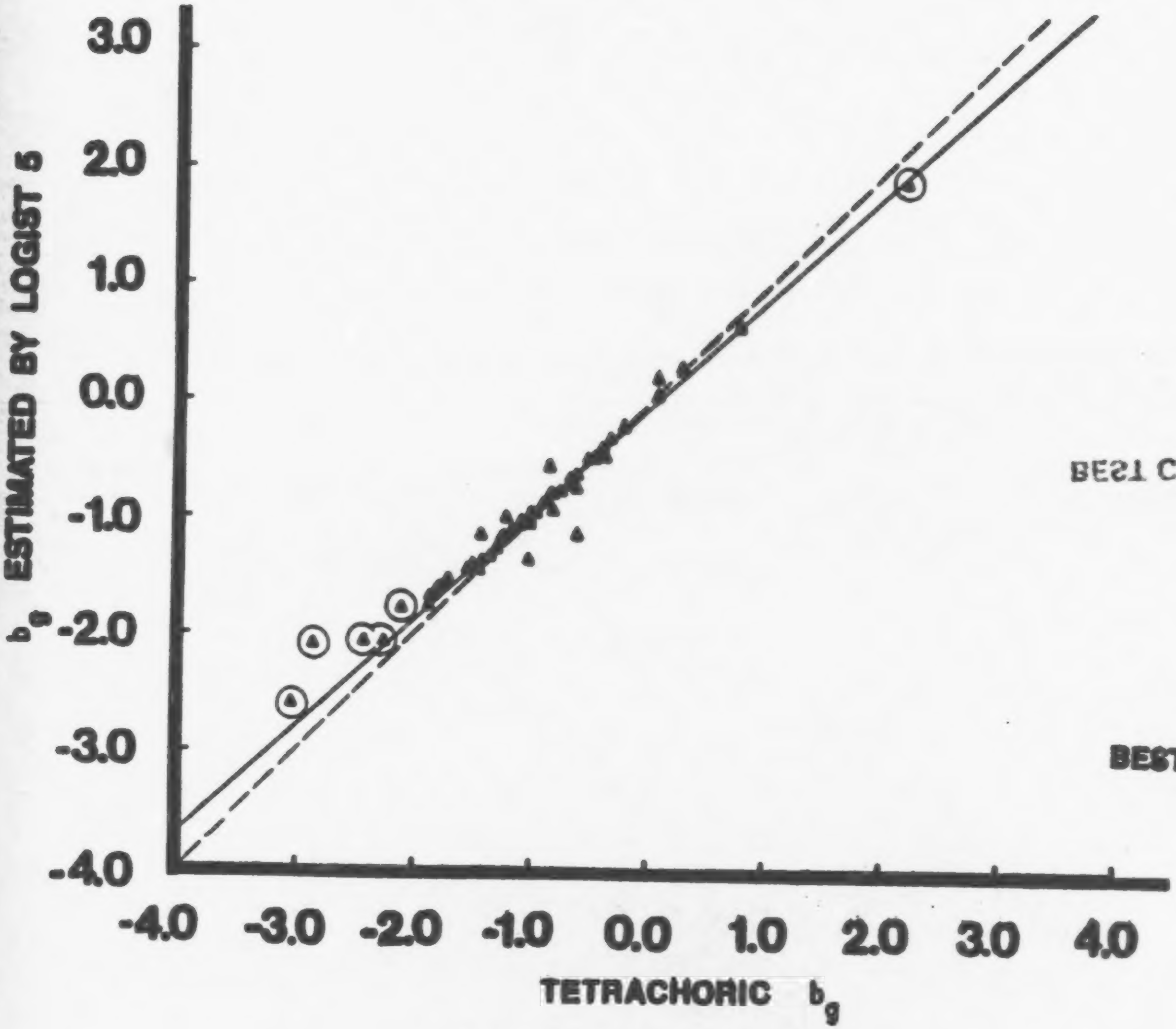

FIGURE 8-2 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

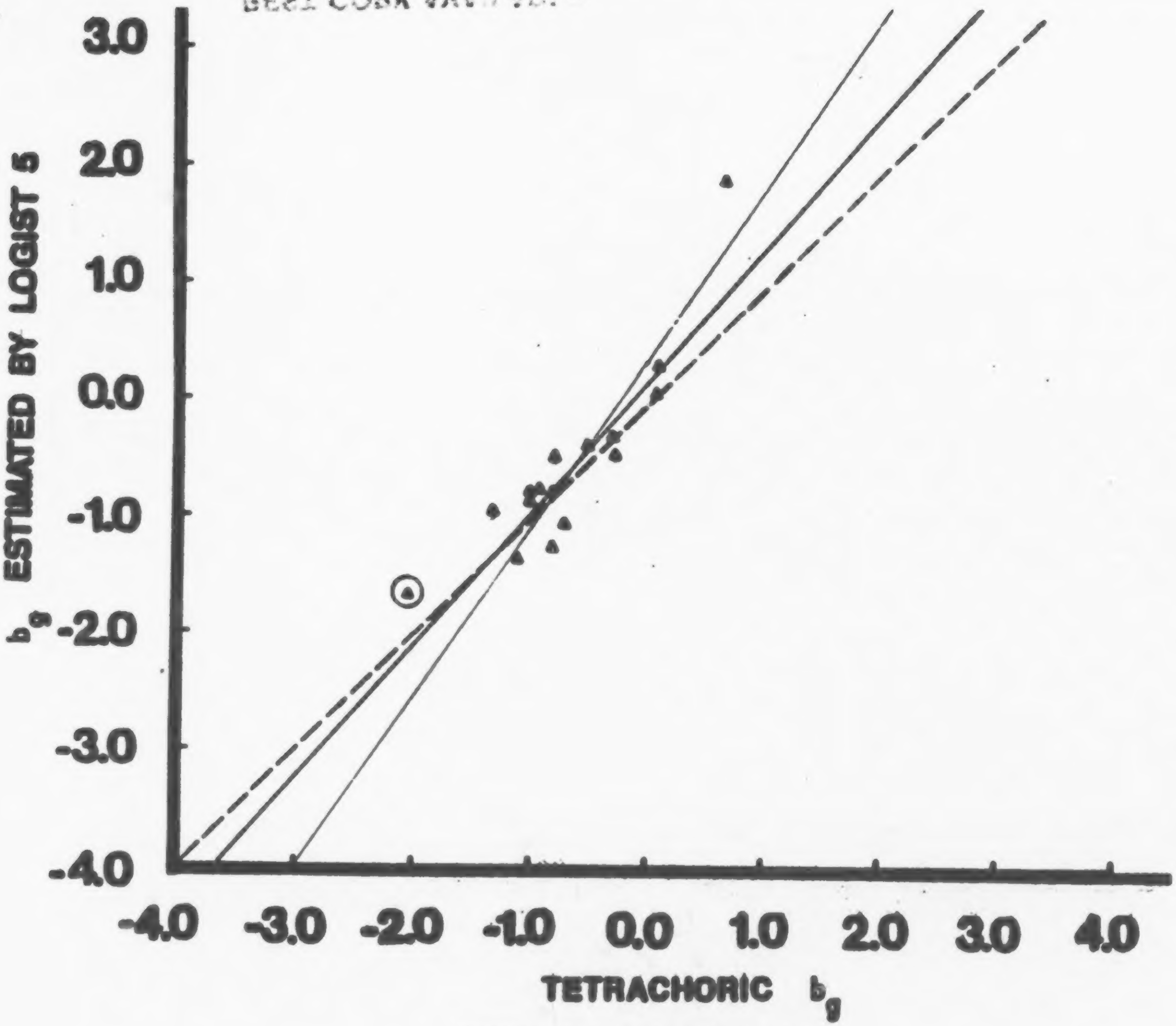

FIGURE 8-2 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

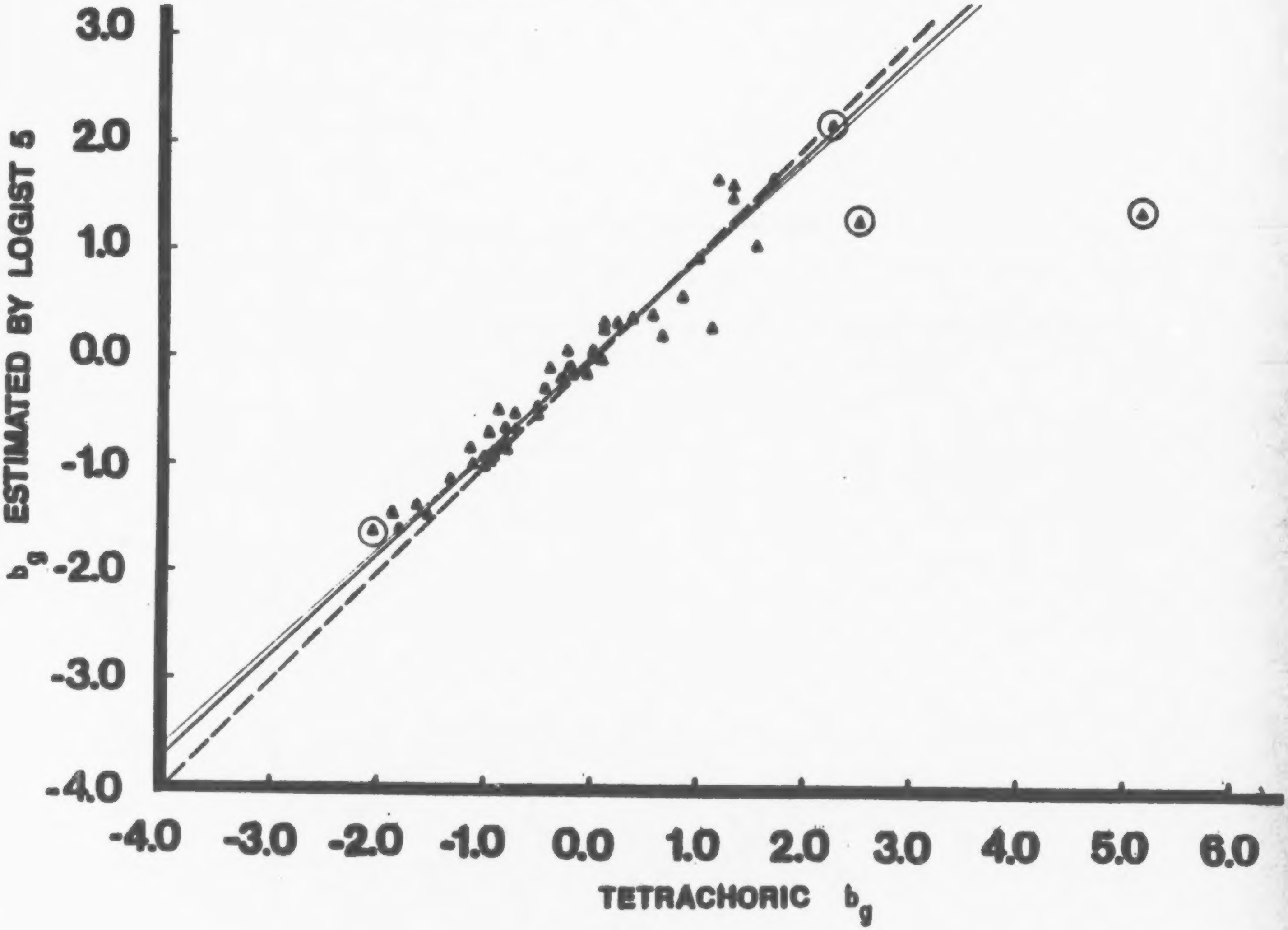

FIGURE 8-2 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

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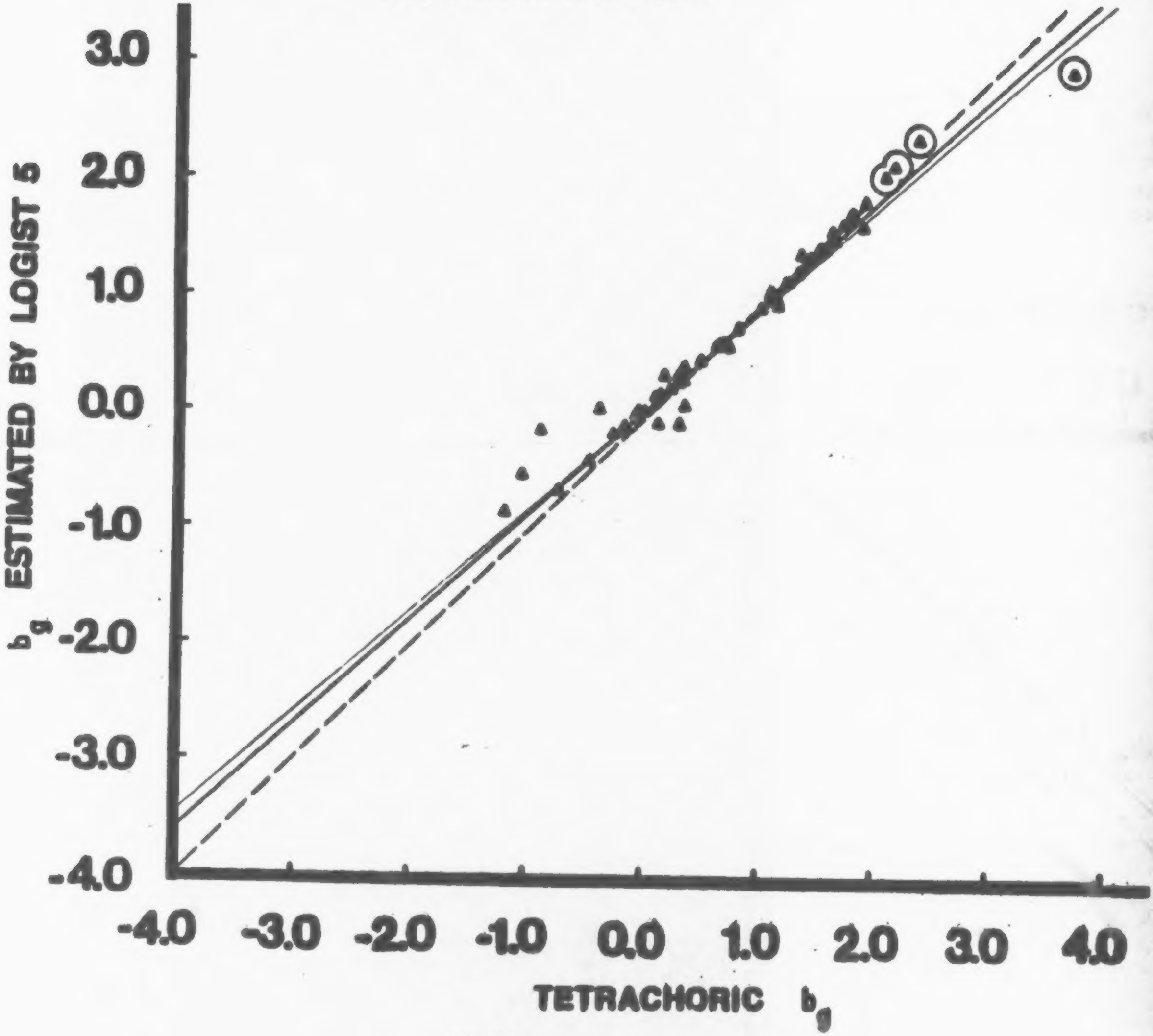

FIGURE 8-2 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

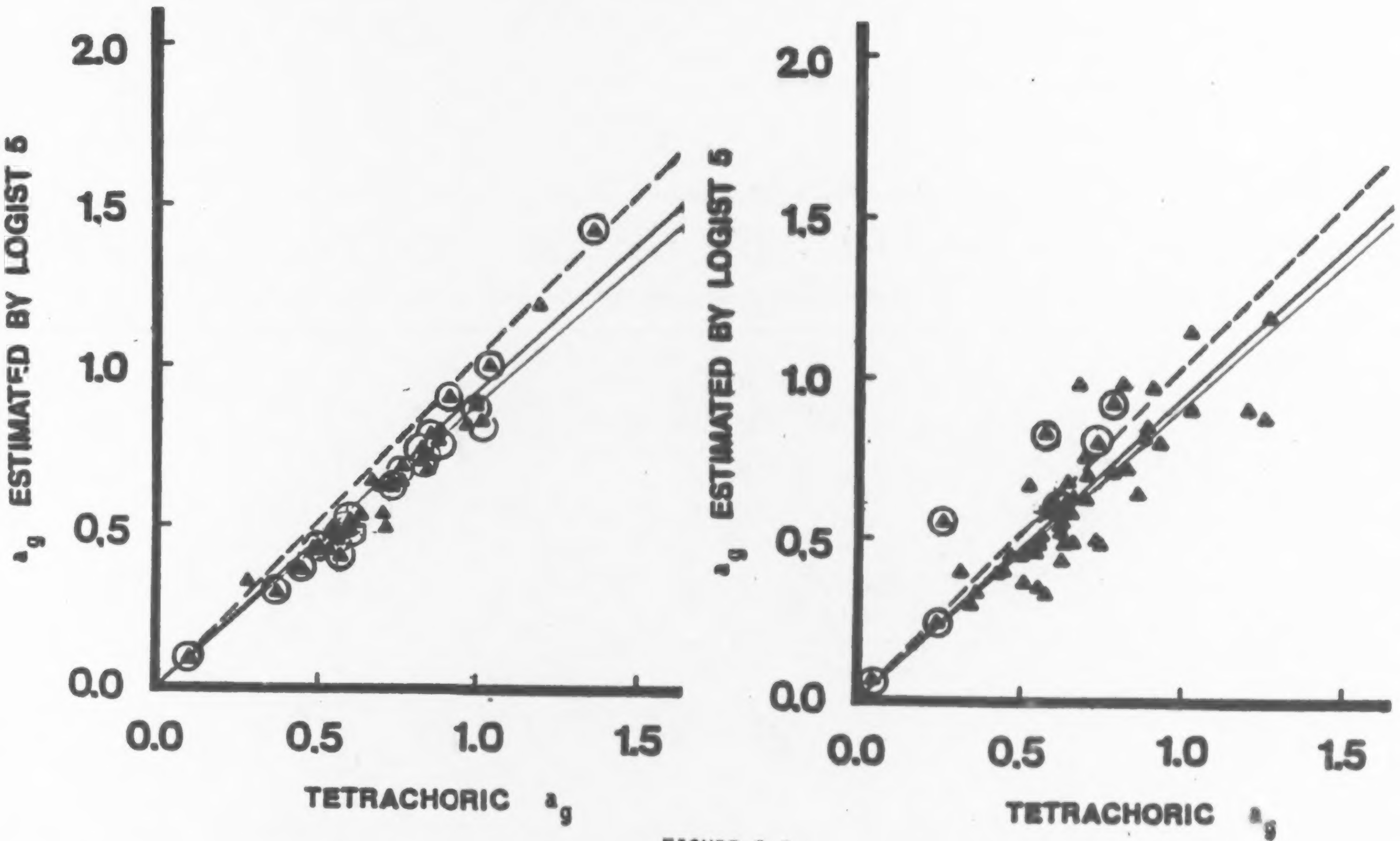

FIGURE 8-3

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic - Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6-J1-J2 on the Ordinate.

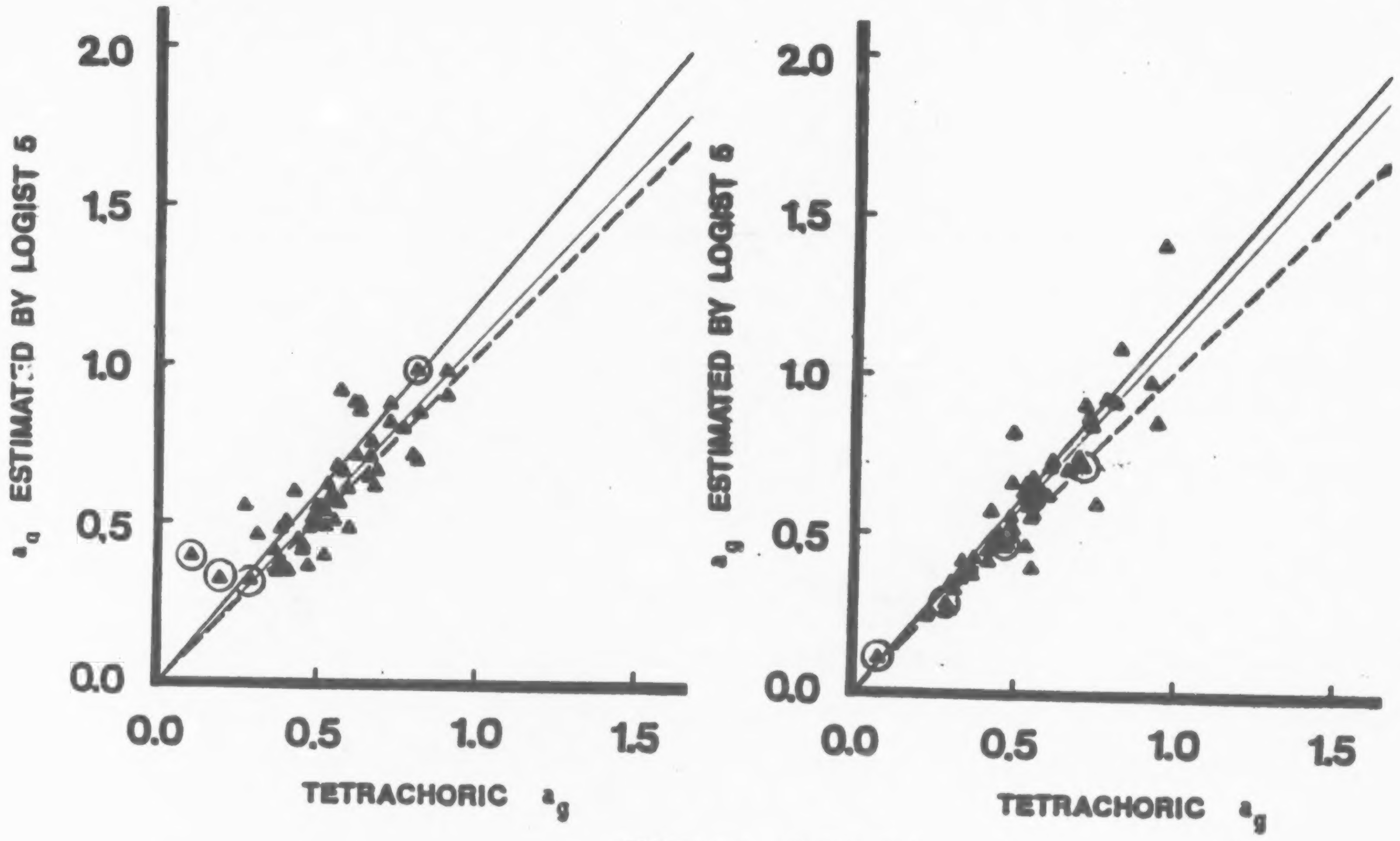

FIGURE 8-3 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

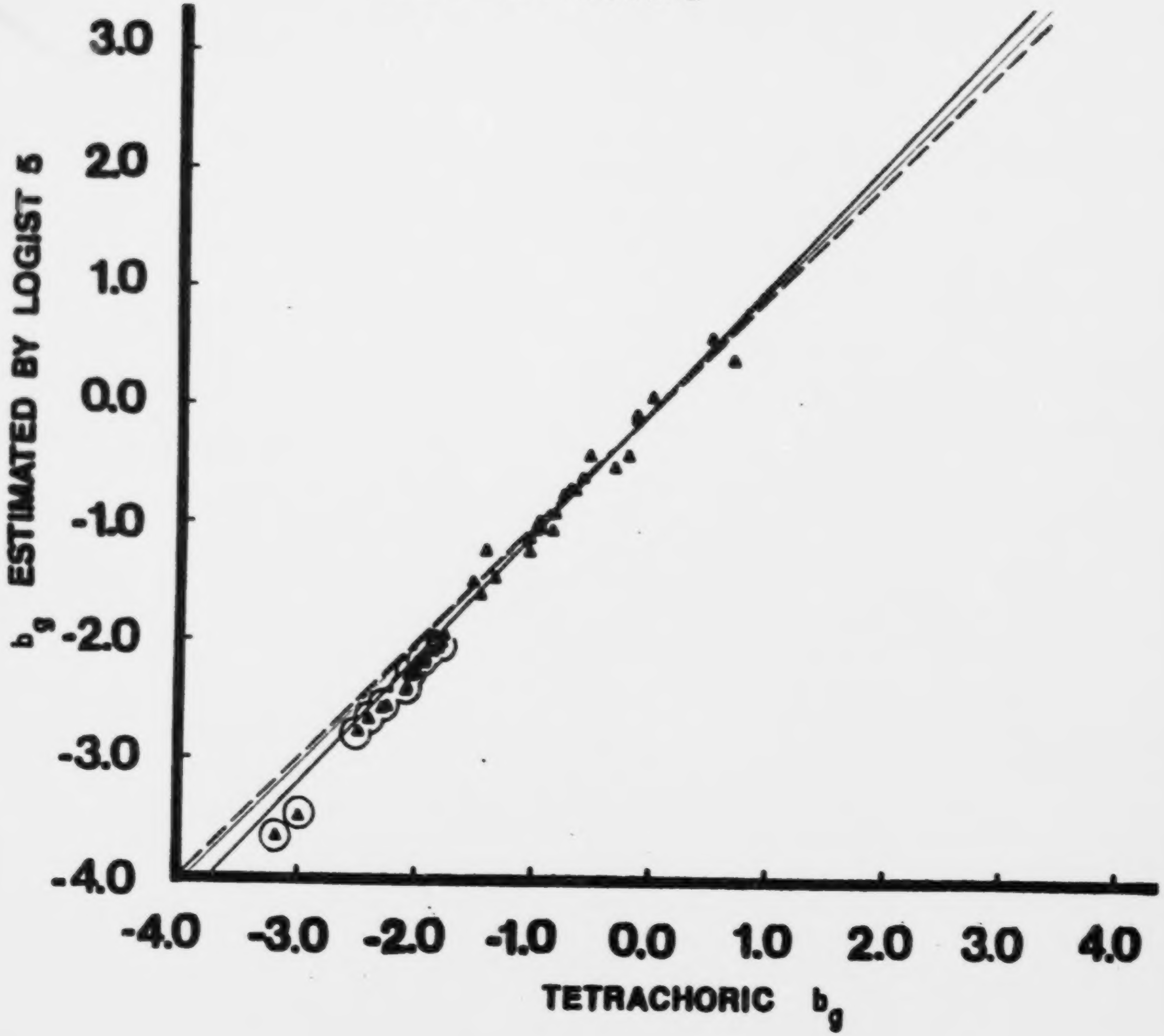

FIGURE 8-4

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter $c_g$ Is Set Equal to Zero, i.e., Logistic Model Is Assumed.

For the 43 Items of Test A5 Excluding Items A523 and A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

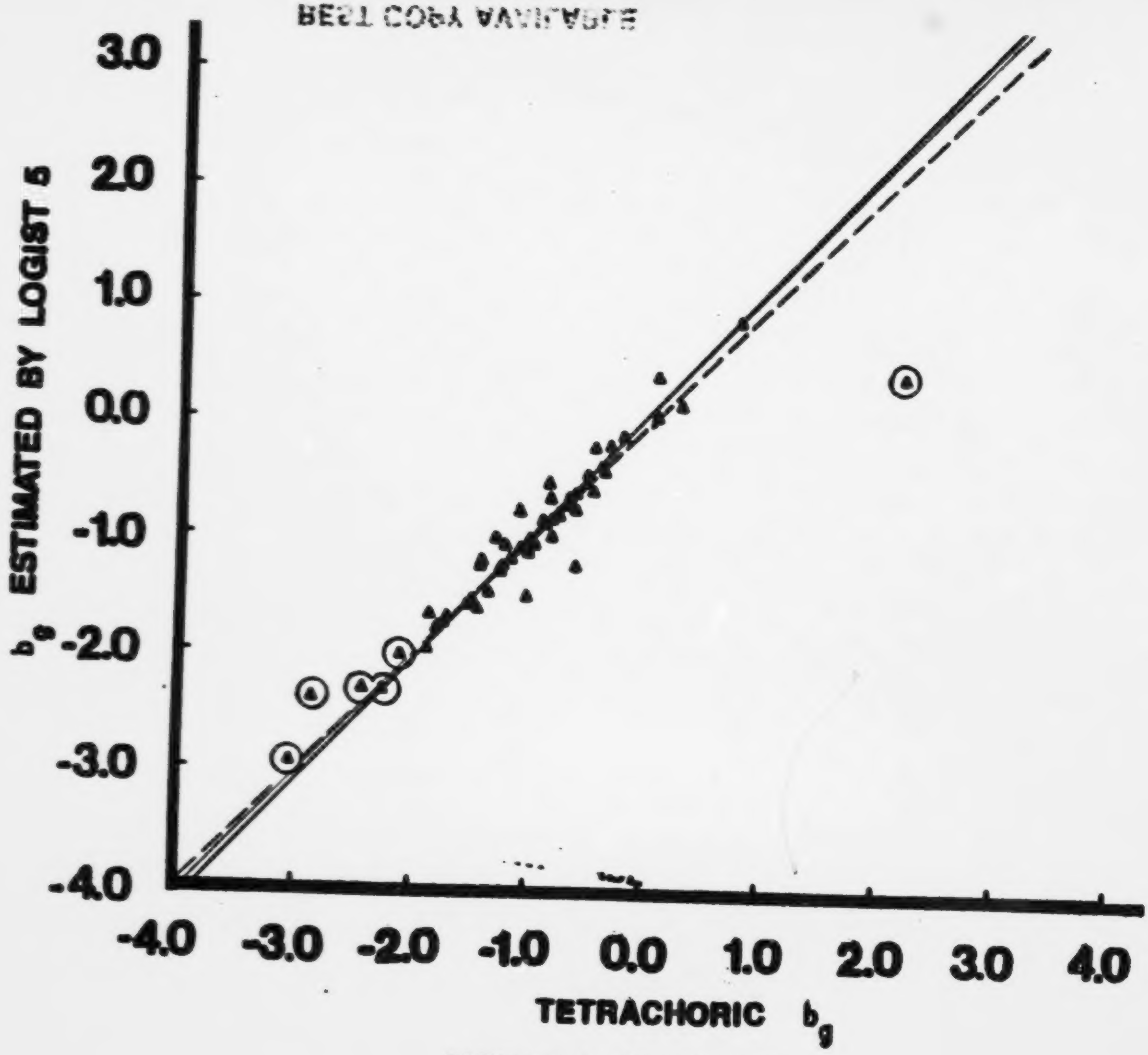

FIGURE 8-4 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

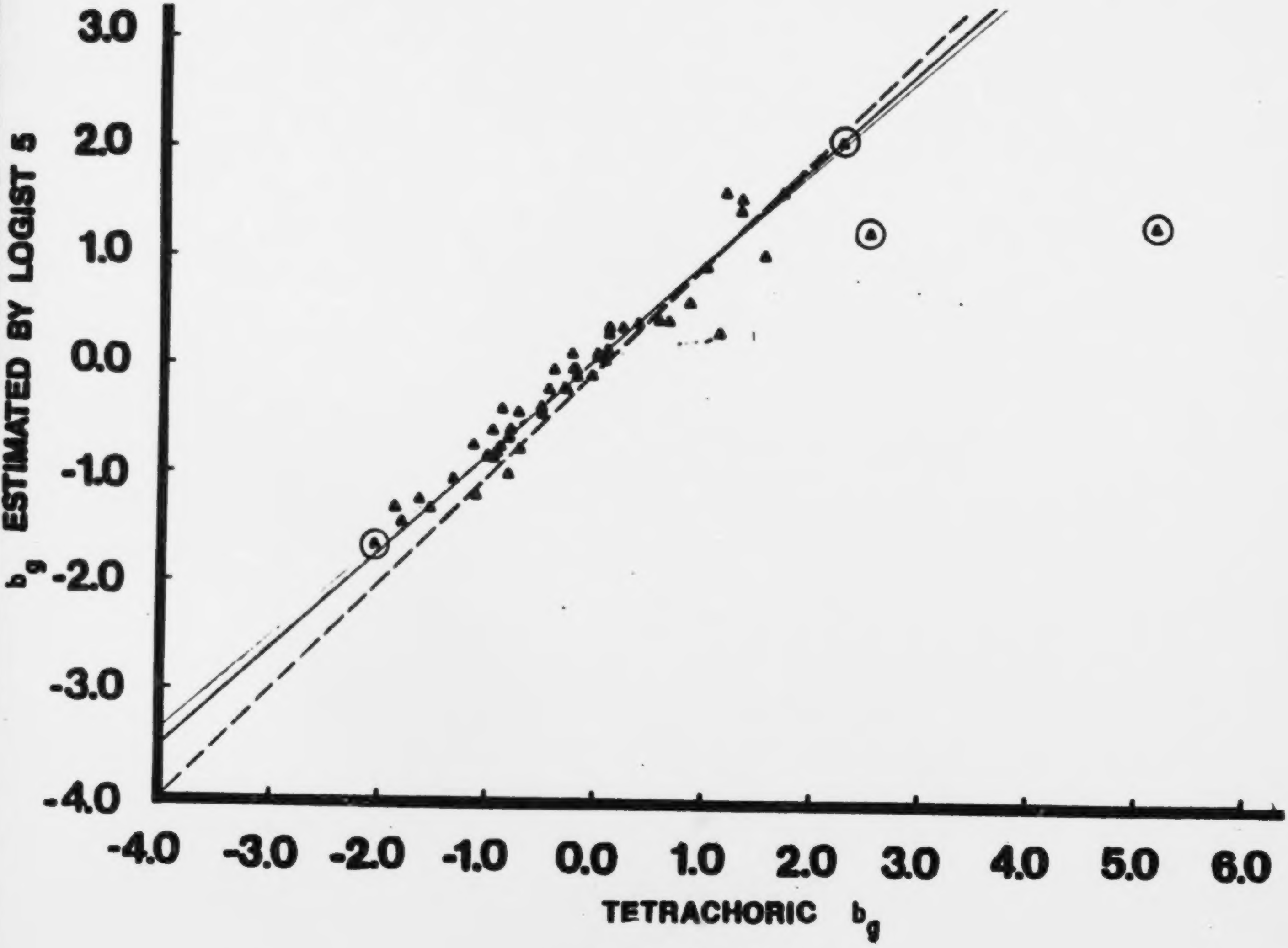

FIGURE 8-4 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

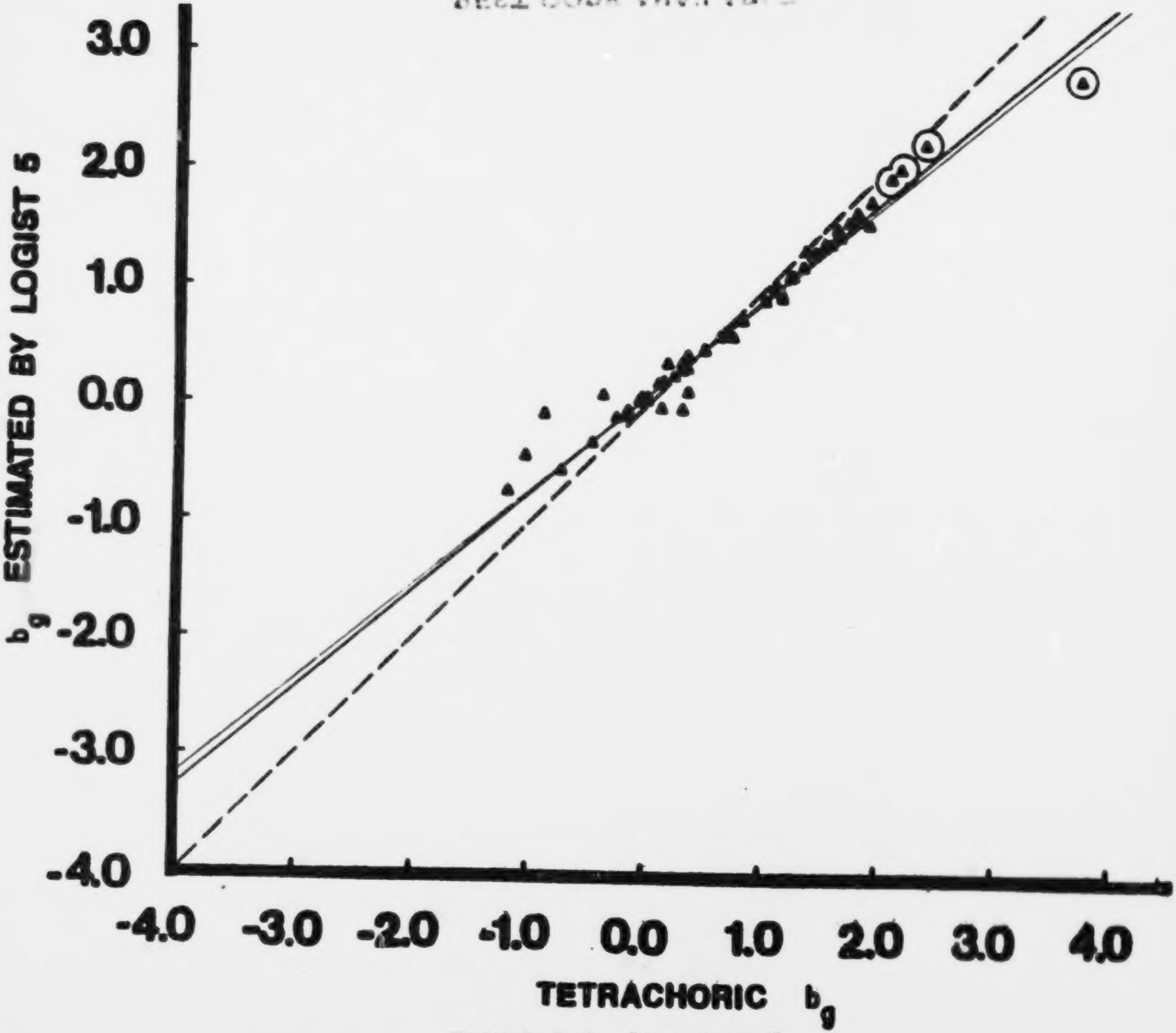

FIGURE 8-4 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

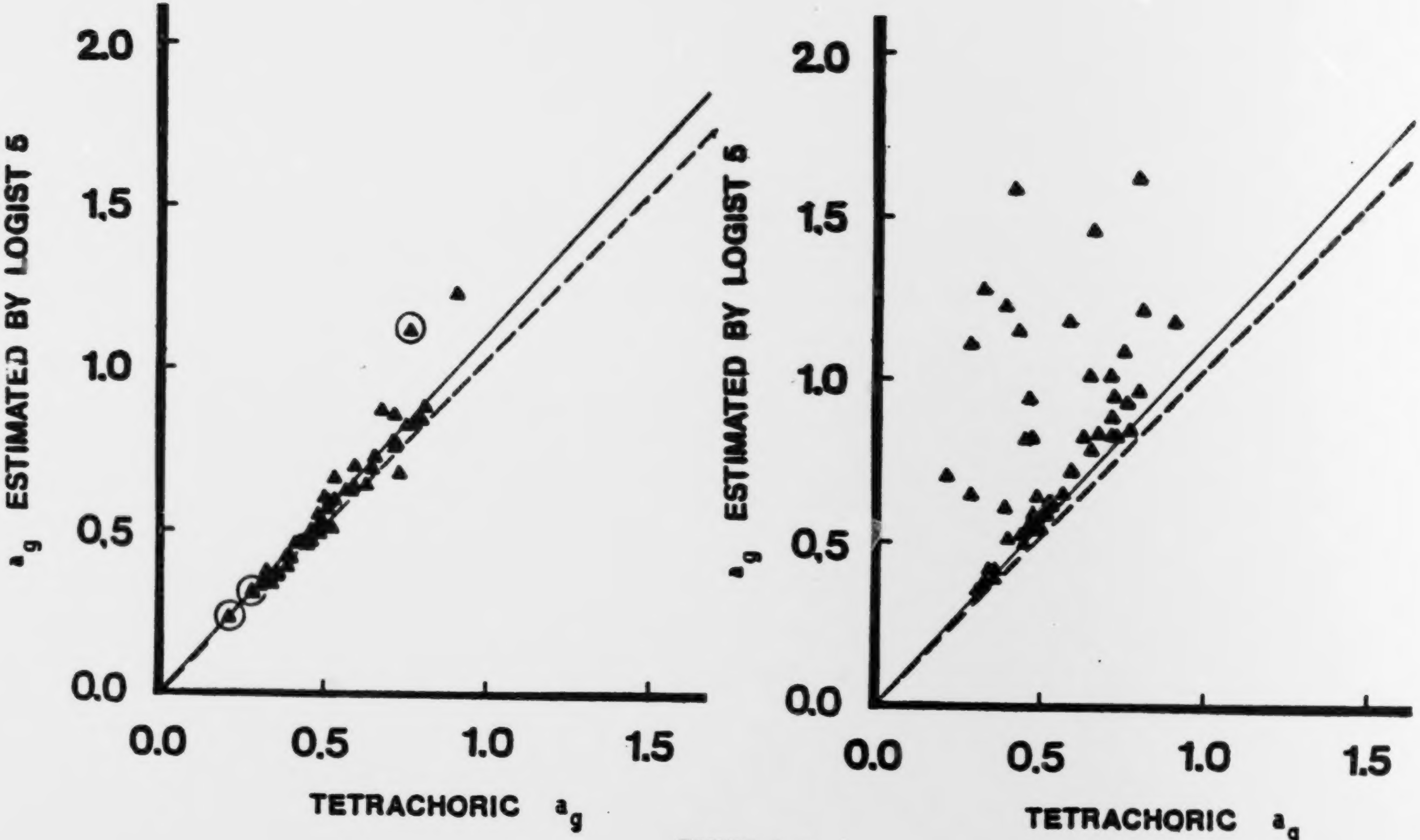

FIGURE 8-5

Estimated Item Discrimination Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Logistic Model Is Assumed in the Graph on the Left Hand Side And Three-Parameter Logistic Model Is Assumed in the Graph on the Right Hand Side. The Best Fitted Linear Relationship When the Logistic Model Is Asssumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. J1/1075 Case.

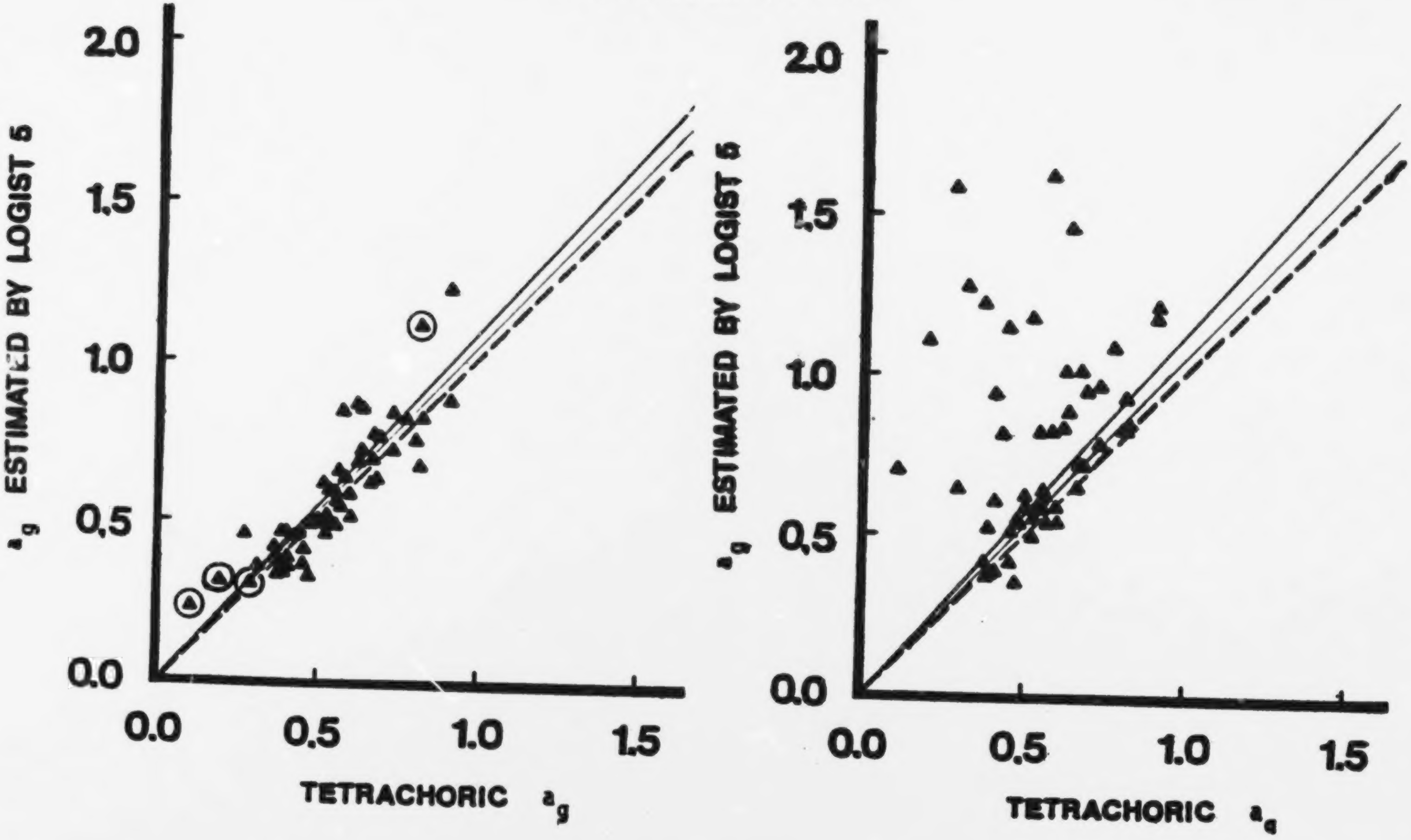

FIGURE 8-5 (Continued)

J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

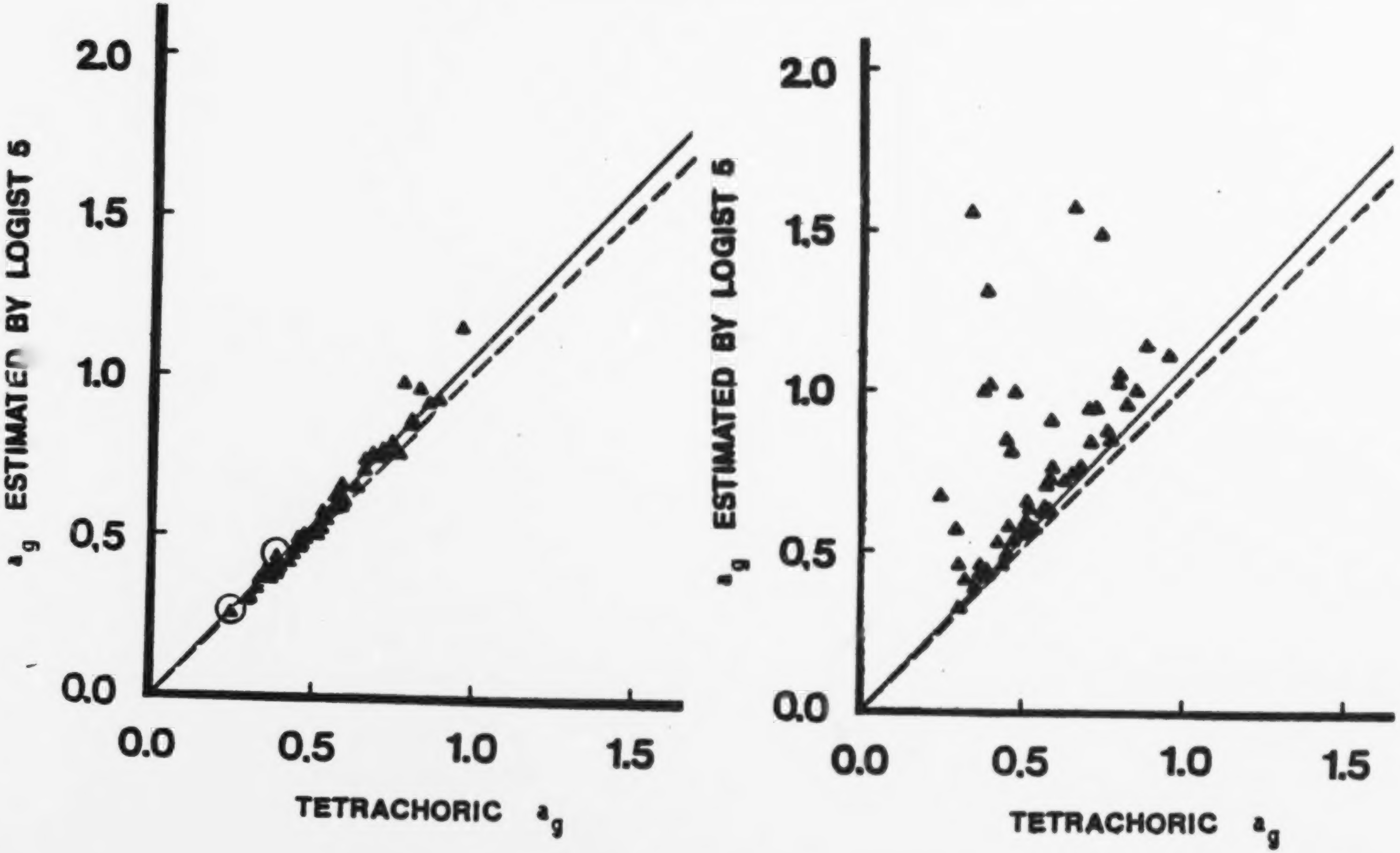

FIGURE 8-5 (Continued): J1/2259 Case.

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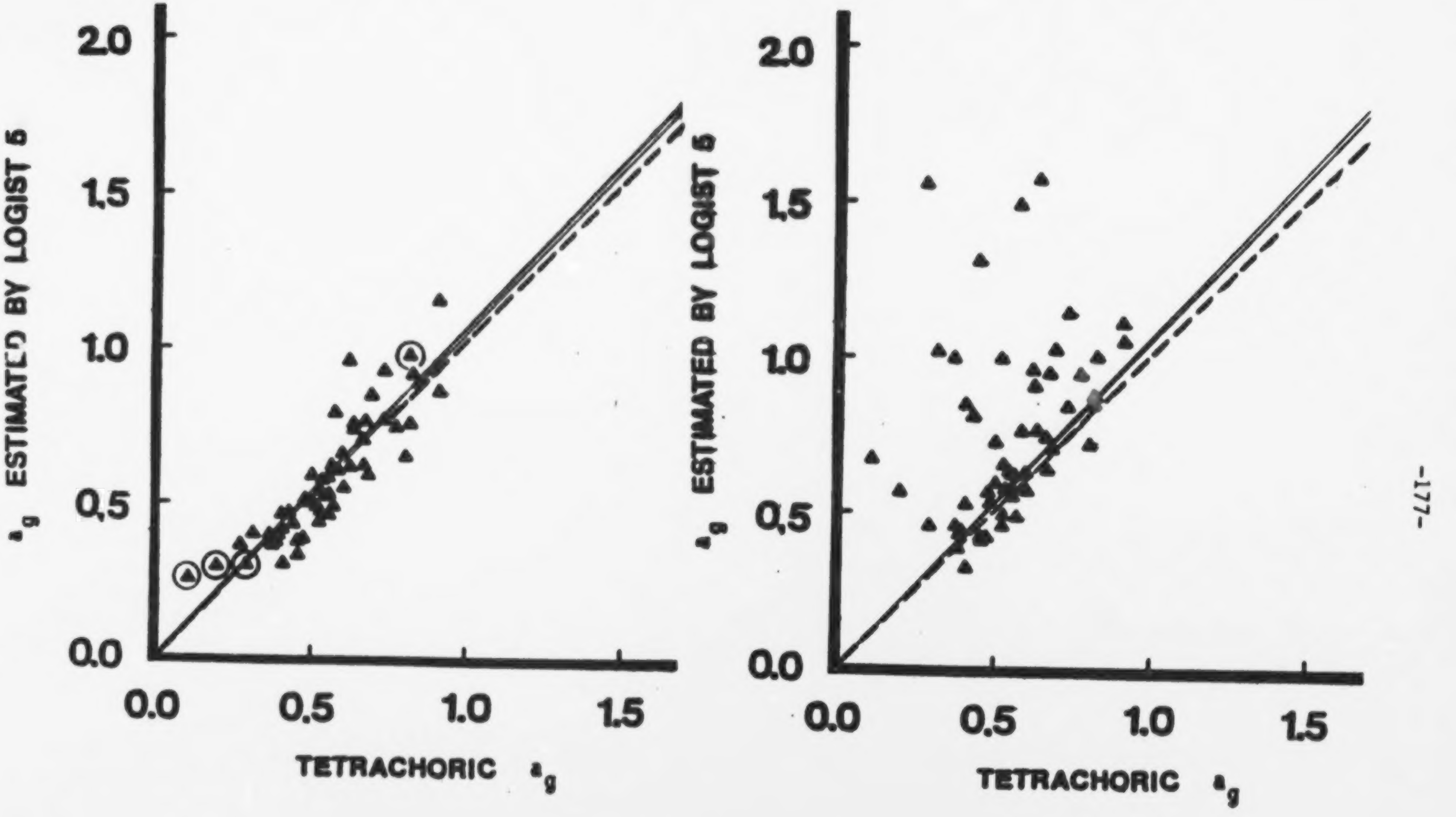

FIGURE 8-5 (Continued)

J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

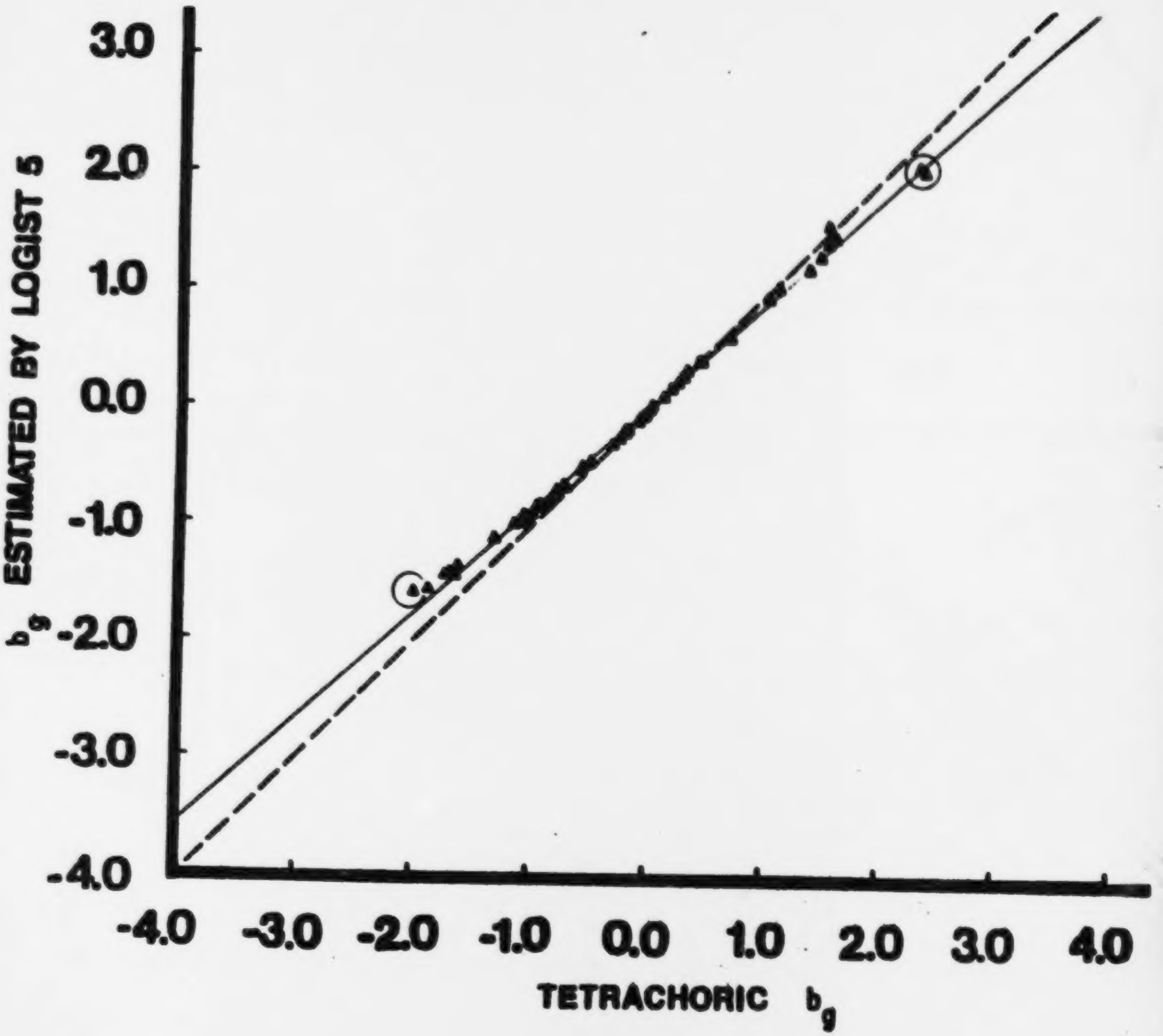

FIGURE 8-6

Estimated Item Difficulty Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

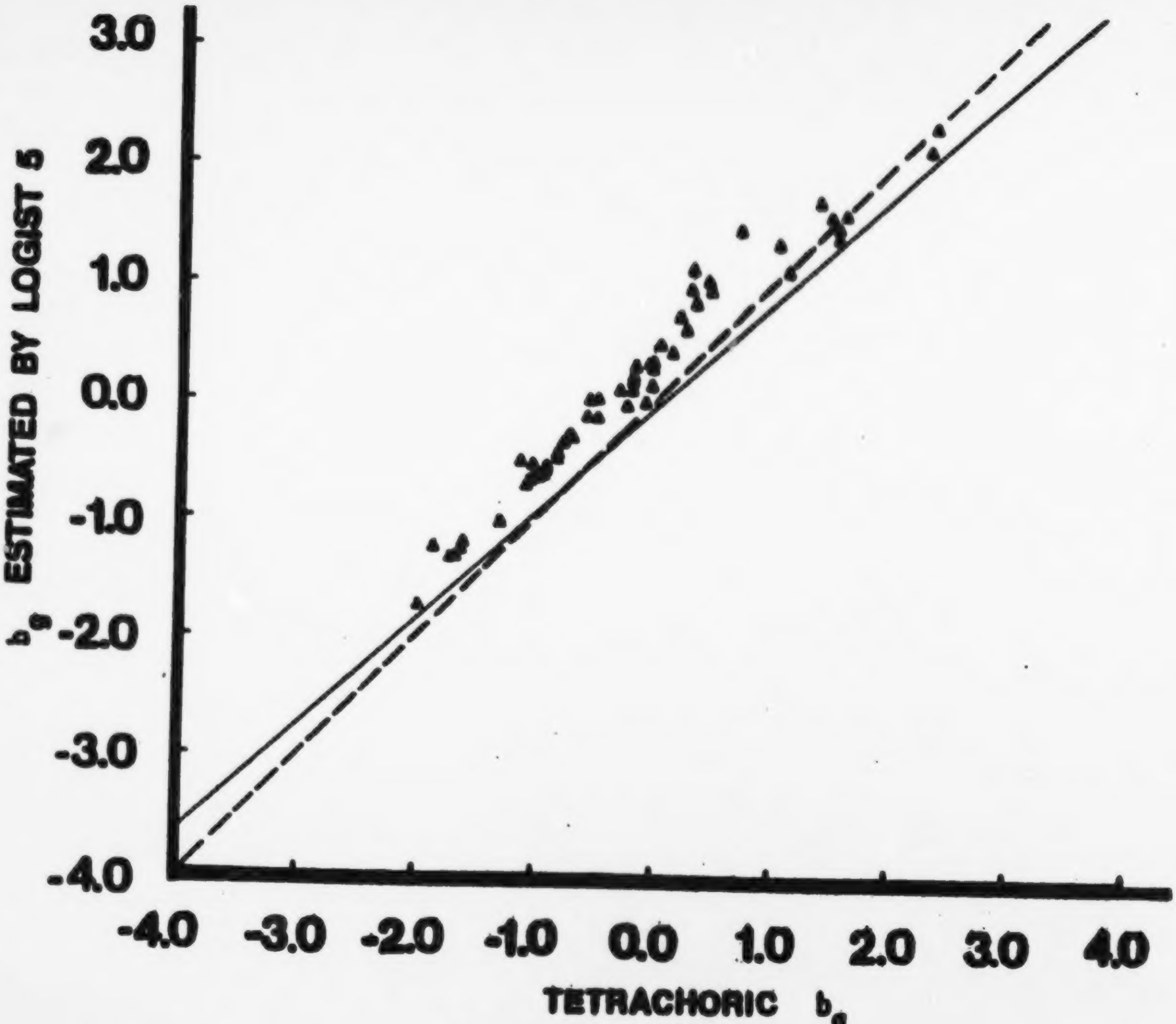

FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

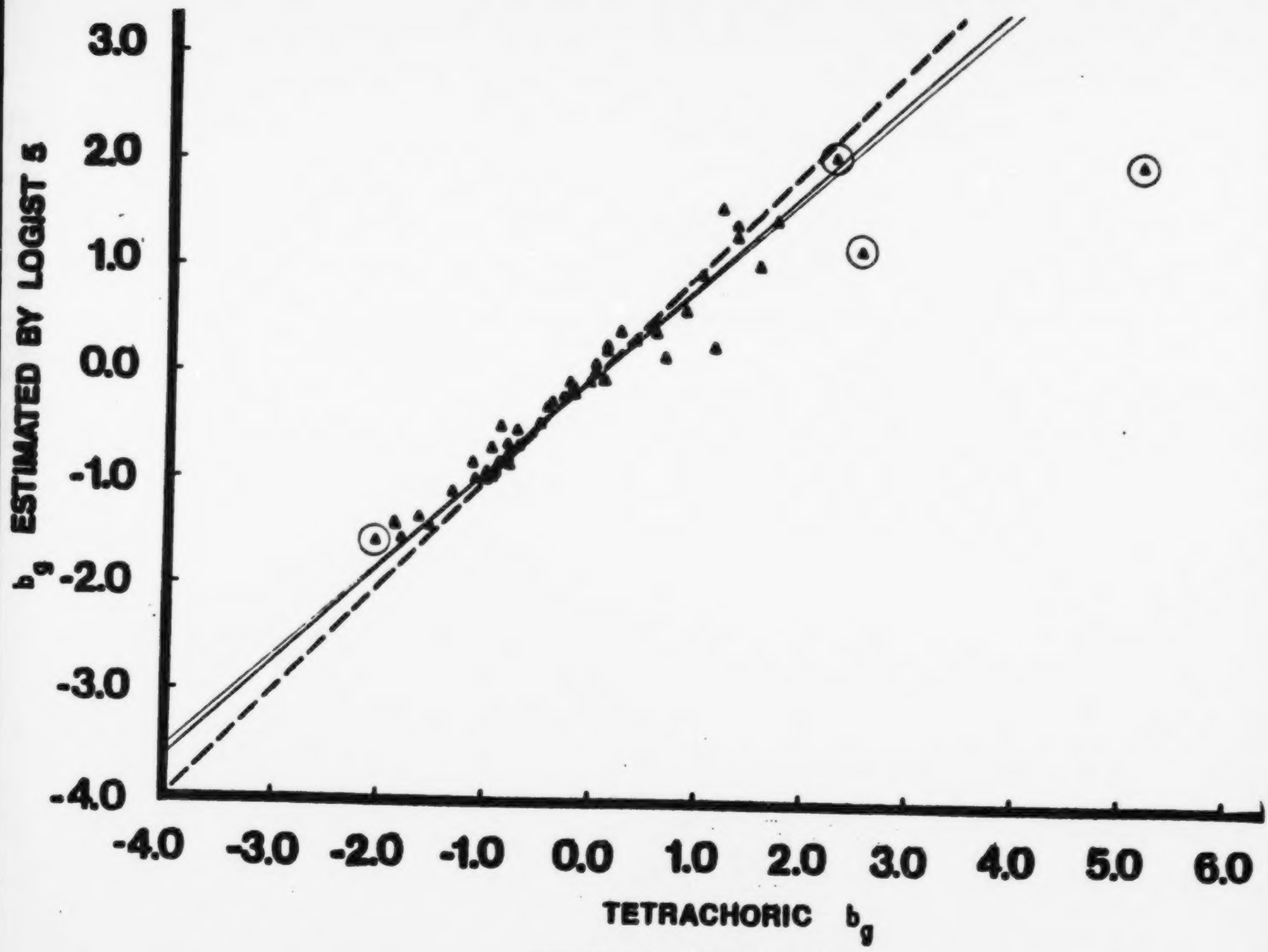

FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

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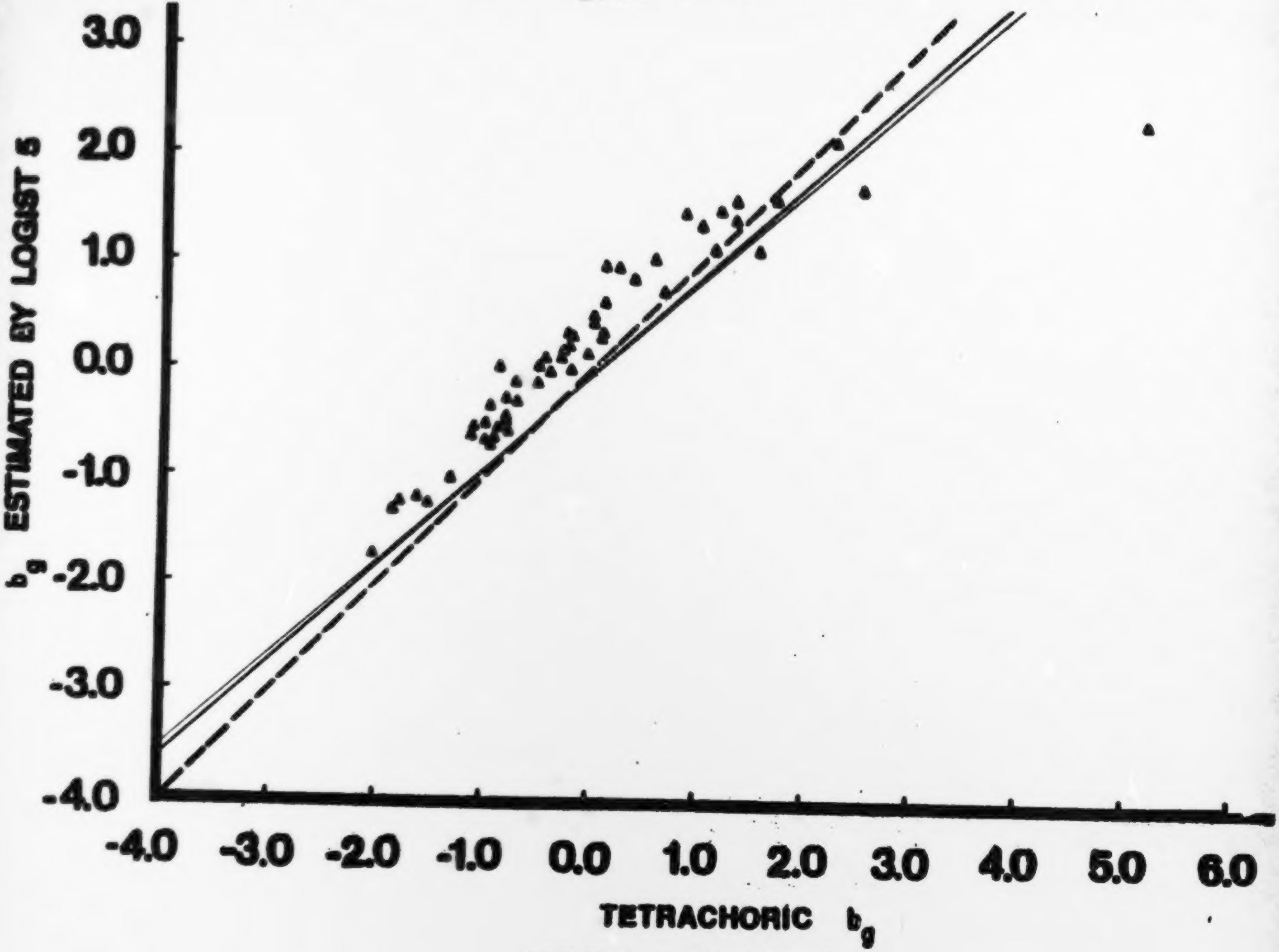

FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

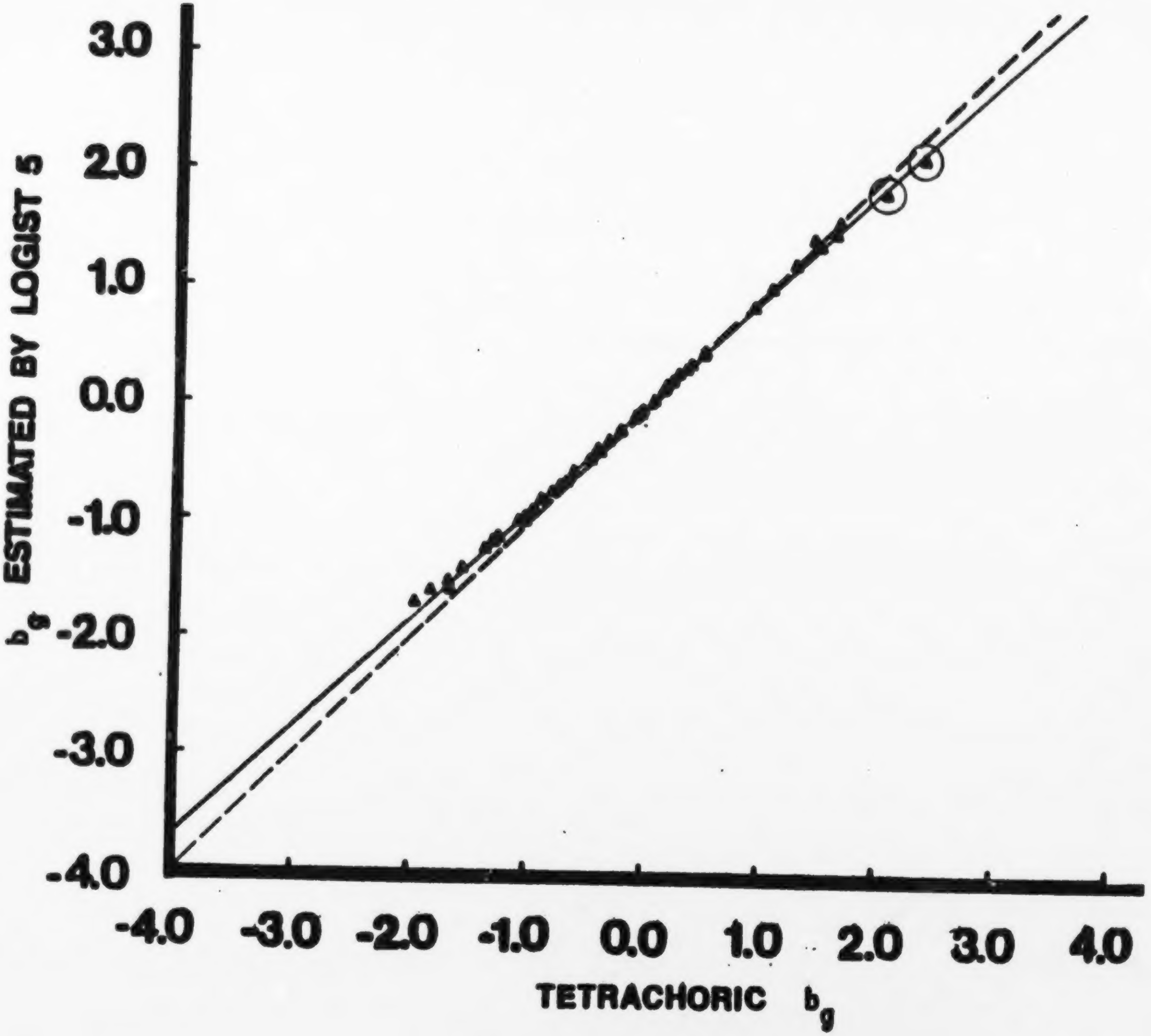

FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

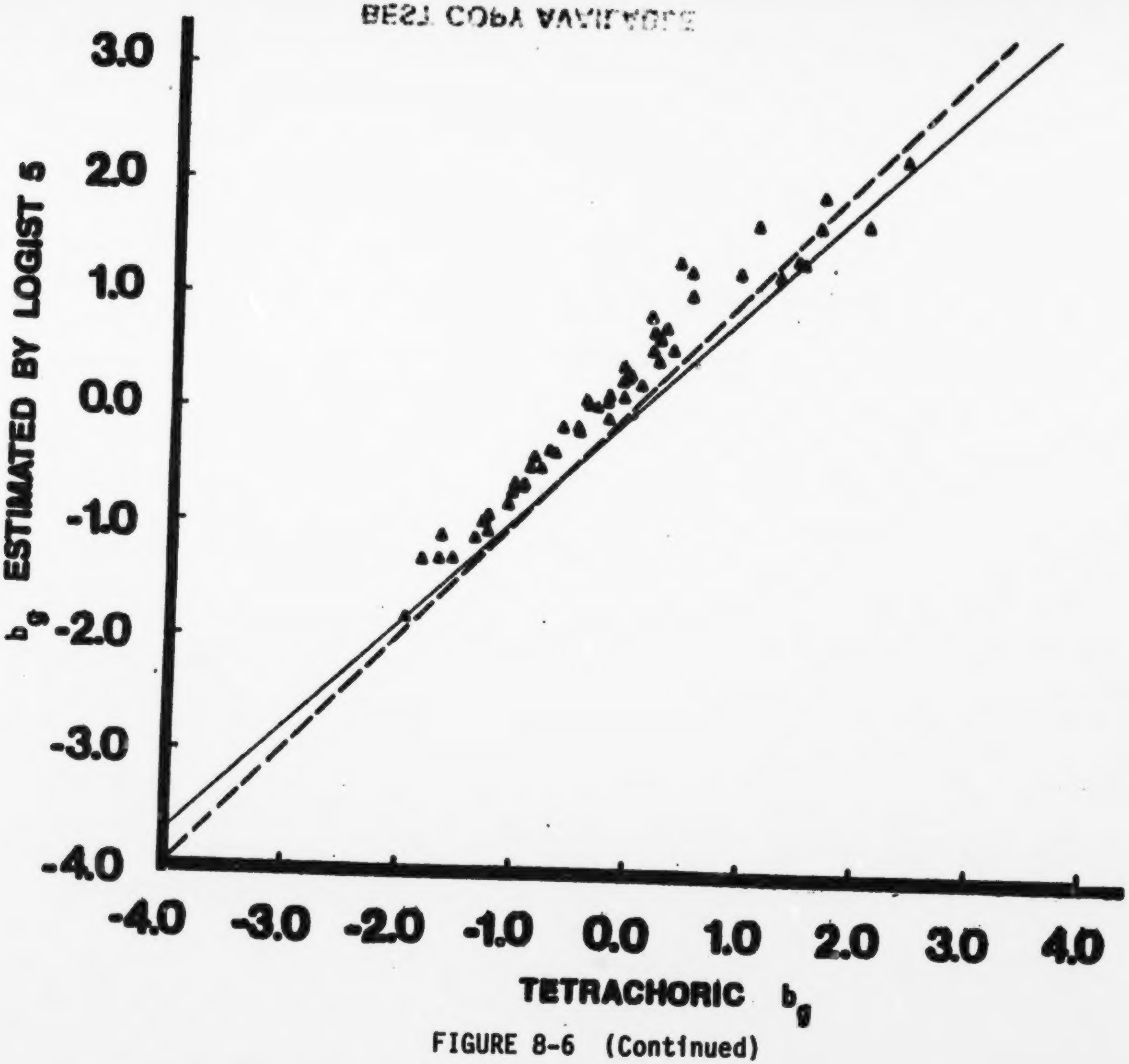

FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

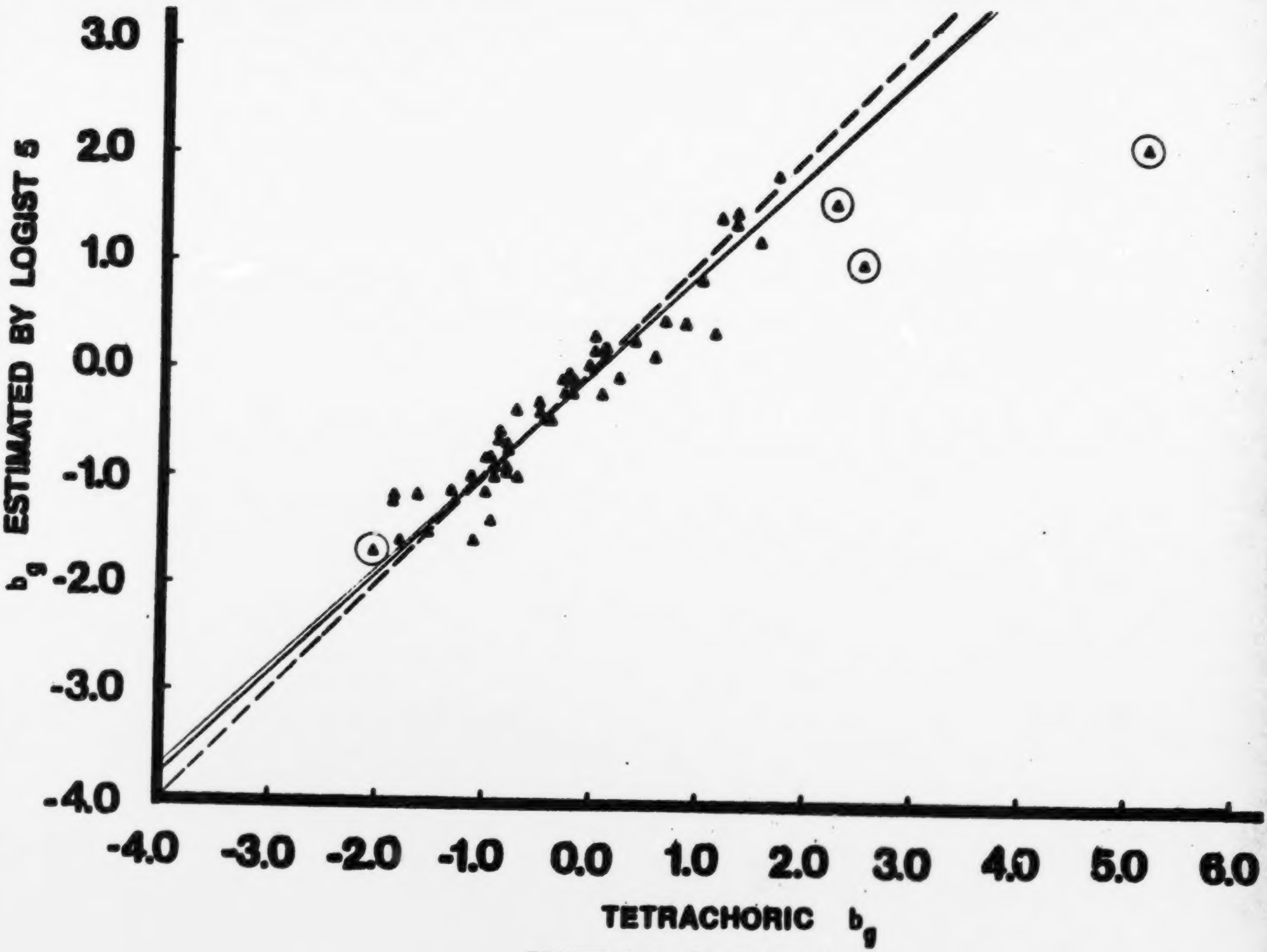

FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

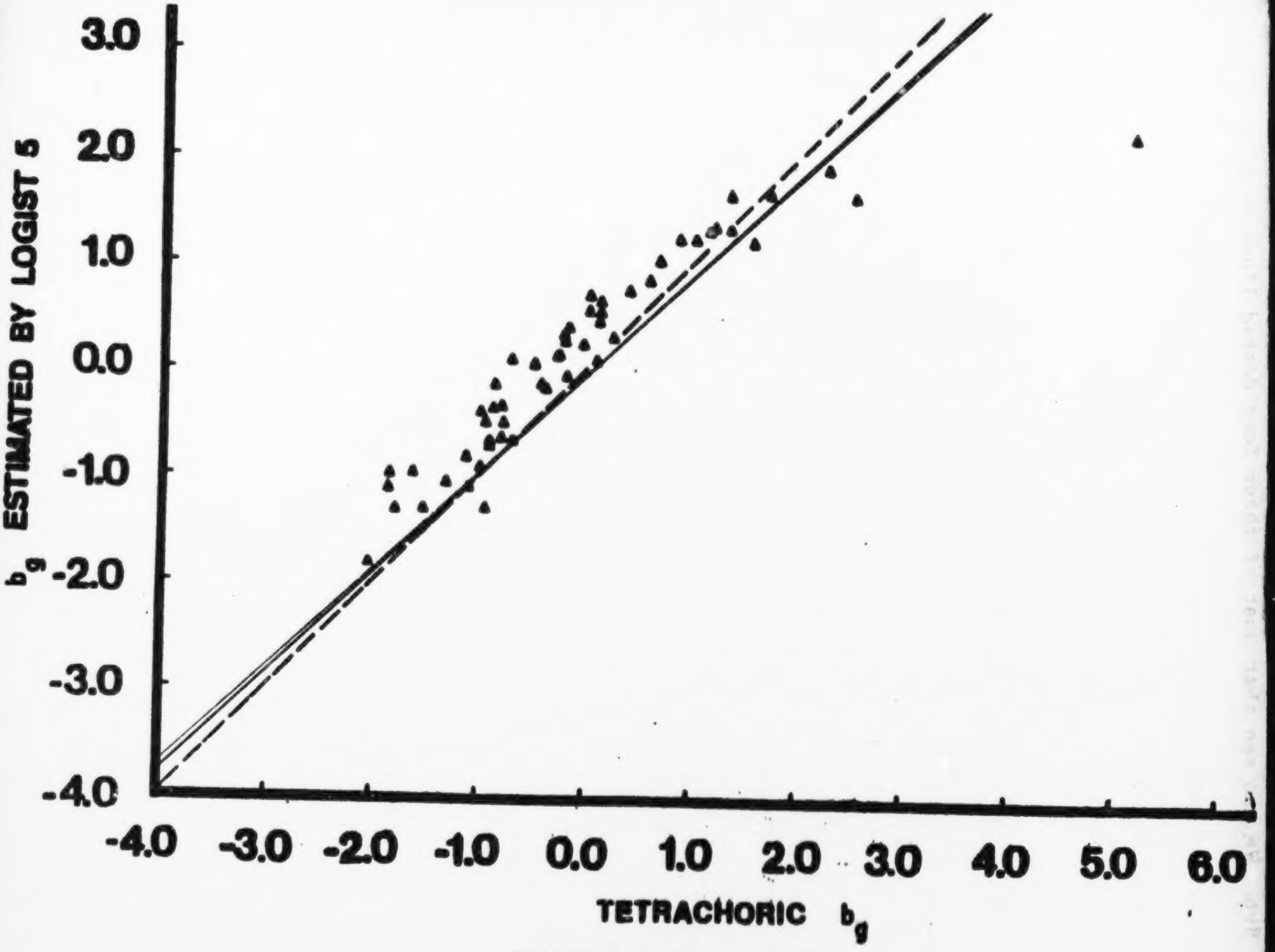

FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

This line is drawn by a long dashed line in each graph of Figures 8-1 through 8-6. We can see that most of these long dashed lines do not pass through the respective scatter diagrams as we expect best fitted linear relationships do.

For the sake of comparison, the best fitted linear iterative relationship for each scatter diagram of Figures 8-1 through 8-6 was obtained by the same iterative method that was described in Section 6, and also the results for $\hat{a}_g$ and for $\hat{b}_g$ were combined. In so doing, all the items whose rescaled estimated difficulty parameters exceed 2.0 were excluded. Table 8-1 presents the slopes and intercepts of the best fitted linear relationships thus obtained. The resulting linear relationships are shown in each graph of Figures 8-1 through 8-6 by thin and thick solid lines, the former of which indicates the direct result obtained for the specific parameter and the latter indicates the combined result. The circled plots in these figures indicate that these items were excluded in the process of using the iterative method for obtaining the respective best fitted linear relationships. As we can see in these graphs and Table 8-1, the best fitted linear relationship is substantially different from the corresponding long dashed line in most cases.

Thus we shall throw away the assumption that the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of $\theta$, and go back to Table 7-25, which is presented at the end of the preceding section. Table 8-2 presents the direct estimates of the mean and the standard deviation of the distribution

## TABLE 8-1

Slope And Intercept of Each of the Fitted Linear Relationship between the Two Sets of Estimated Discrimination Parameters, And Also Those of Estimated Difficulty Parameters, of the Common Test Items, Which Were Obtained by the Tetrachoric Method (Examinee Group 1) And by Logist 5 (Examinee Group 2), after Scale Adjustment I.

| Examinee Group 1 | Examinee Group 2 | $\hat{a}_g$ | | Combined | $\hat{b}_g$ | | Combined | |
|---|---|---|---|---|---|---|---|---|
| | | Slope | Intercept | Slope | Slope | Intercept | Slope | Intercept |
| A5/0599 | A5-A6 | 1.106 | -0.016 | 1.120 | 0.882 | -0.149 | 0.893 | -0.138 |
| A6/0412 | A5-A6 | 1.068 | -0.009 | 1.078 | 0.919 | -0.040 | 0.928 | -0.032 |
| J1/0614 | A5-A6 | 1.146* | -0.028* | 0.881* | 1.476* | 0.380* | 1.135* | 0.180* |
| J1/0614 | J1-J2 | 1.032 | -0.007 | 1.061 | 0.917 | 0.033 | 0.943 | 0.041 |
| J2/0758 | J1-J2 | 1.055 | -0.009 | 1.097 | 0.876 | 0.062 | 0.912 | 0.039 |
| A5/0599 | A5-A6-J1-J2 | 0.878 | -0.007 | 0.926 | 1.025 | -0.044 | 1.080 | -0.005 |
| A6/0412 | A5-A6-J1-J2 | 0.908 | -0.007 | 0.933 | 1.044 | 0.055 | 1.072 | 0.081 |
| J1/0614 | A5-A6-J1-J2 | 1.080 | -0.004 | 1.112 | 0.873 | 0.079 | 0.899 | 0.087 |
| J2/0758 | A5-A6-J1-J2 | 1.139 | -0.010 | 1.185 | 0.811 | 0.113 | 0.844 | 0.093 |
| J1/1075 | J1/1075 | 1.102 | -0.006 | 1.105 | 0.903 | 0.016 | 0.905 | 0.016 |
| J1/0614 | J1/1075 | 1.067 | -0.008 | 1.104 | 0.876 | 0.008 | 0.906 | 0.017 |
| J1/2259 | J1/2259 | 1.075 | -0.007 | 1.075 | 0.931 | 0.016 | 0.931 | 0.016 |
| J1/0614 | J1/2259 | 1.060 | -0.009 | 1.072 | 0.923 | 0.008 | 0.933 | 0.012 |

* This is based on only 15 items while all the other results are based on at least 24 items.

TABLE 8-2

Estimated Mean And Standard Deviation of the Distribution of $\hat{\theta}$ for Each Examinee Group Shown As Examinee Group 2, for Which Logist 5 Was Used. Examinee Group 1 Indicates the Group upon Which Tetrachoric Method Was Applied And Whose Result Was Paired with the Result of Examinee Group 2.

| Examinee Group 1 | Examinee Group 2 | Mean | S.D. |
|---|---|---|---|
| A5/0599 | A5-A6 | -0.67690629289170 00 | 0.9498435120987D 00 |
| A6/0412 | A5-A6 | -0.7567180593797D 00 | 0.9441285727625D 00 |
| J1/0614 | A5-A6 | -0.7540791085704D 00* | 0.8971611496158D 00* |
| Weighted Average | | -0.7094309692449D 00 | 0.9475145753959D 00 |
| J1/0614 | J1-J2 | 0.7790302264265D 00 | 0.1376714237914D 01 |
| J2/0758 | J1-J2 | 0.8197747749259D 00 | 0.1406229808384D 01 |
| Weighted Average | | 0.8015406985566D 00 | 0.1393020945214D 01 |
| A5/0599 | A5-A6-J1-J2 | 0.1883270334869D 00 | 0.1216020629981D 01 |
| A6/0412 | A5-A6-J1-J2 | 0.1514122790061D 00 | 0.1285118299006D 01 |
| J1/0614 | A5-A6-J1-J2 | 0.1704262695468D 00 | 0.1522456056989D 01 |
| J2/0758 | A5-A6-J1-J2 | 0.1938391161783D 00 | 0.1601146033909D 01 |
| Weighted Average | | 0.1790858294478D 00 | 0.1429425853648D 01 |
| J1/1075 | J1/1075 | 0.3017500674956D 00 | 0.1205953781811D 01 |
| J1/0614 | J1/1075 | 0.2970263355266D 00 | 0.1202006556190D 01 |
| Weighted Average | | 0.3000328552819D 00 | 0.1204518851952D 01 |
| J1/2259 | J1/2259 | 0.3018676309476D 00 | 0.1077806694358D 01 |
| J1/0614 | J1/2259 | 0.3031684135164D 00 | 0.1080768213593D 01 |
| Weighted Average | | 0.3021456262477D 00 | 0.1078439612148D 01 |

* This is based on only 14 items while all the other results are based on at least 36 items. This result was excluded from the computation of the weighted average.

of $\hat{\theta}$ for each of the three examinee groups, A5/0599, A6/0412 and J2/0758 Cases, and also of the two examinee groups, J1/1075 and J1/2259, which was obtained from the combined linear relationship in each case. Since there are more than one way of obtaining these two values in each case, all of these results are presented in Table 8-2. In this table, Examinee Group 1 indicates the group of examinees upon which the item parameters were estimated by Tetrachoric Method, and Examinee Group 2 means the group of individuals upon which they were estimated by Logist 5 . Thus the mean and the standard deviation of the distribution of $\hat{\theta}$ of Case J1-J2, for example, can be estimated in two ways, i.e., through the scatter diagrams of the estimated parameters of the items of Test J1, and through those of the items of Test J2. Since the mean and the standard deviation of the distribution of $\theta$ for each of J1/0614 Case and J2/0758 Case were already estimated and are shown in Table 6-3, from the slope and the intercept of the combined linear relationship shown in Table 7-25 and by using the method described in Section 6, we can obtain the estimates of the mean and the standard deviation of the distribution of $\hat{\theta}$ of Case J1-J2 in each case. In the same table, the weighted averages of the estimated mean and standard deviation of the distribution of $\hat{\theta}$ are also given for each examinee group. The weight adopted here is the number of the examinees in Examinee Group 1. We can see in these results that most estimates for the same group of examinees are close to each other. One exception is seen in Case A5-A6-J1-J2, however, for which the four estimates of the standard deviation of the distribution of $\hat{\theta}$ are substantially different from one another.

The estimated item discrimination and difficulty parameters of each of the items of Tests A5, A6, J1 and J2, which are shown in Tables 7-1 through 7-12, were transformed through (6.1) and (6.18) by setting $\mu_1 = 0$ and $\sigma_1 = 1$ and by using the results shown in Table 8-2 as $\mu_2$ and $\sigma_2$. In so doing, each separate set of the estimated mean and standard deviation were used, not their weighted averages. These results are shown in Tables 8-3 through 8-14. As was expected, the two sets of the parameter estimates of Test J1 obtained upon Case J1/1075: $c_g$-Zero and upon Case J1/2259: $c_g$-Zero, which are shown in Tables 8-11 and 8-13, respectively, are very close to each other. Note that they are also close to the corresponding two sets of results obtained by Tetrachoric Method, which are shown as Tables 6-8 and 6-9.

## IX. Comparison of the Estimated Item Characteristic Functions Obtained As the Results of the Logist 5 and Those Obtained by the Tetrachoric Method

Figures 9-1 through 9-4 present five estimated item characteristic functions for each of the items of Tests A5, A6, J1 and J2. In each graph, the result based upon the estimated item parameters obtained by Tetrachoric Method, which are shown in Tables 6-4 through 6-7, is drawn by a solid line, and all the other four curves of different lengths of dashes concern with those based upon the estimated item parameters by Logist 5. Note that the first

## TABLE 8-3

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.842 | -2.308 |
| A502 | 0.587 | -3.269● |
| A503 | 0.669 | -3.406● |
| A504 | 0.703 | -2.065 |
| A505 | 0.887 | -2.395 |
| A506 | 0.526 | -2.049 |
| A507 | 0.561 | -0.968 |
| A508 | 0.866 | -1.852 |
| A509 | 1.614 | -1.961 |
| A510 | 0.724 | -0.955 |
| A511 | 0.545 | -2.172 |
| A512 | 0.777 | -1.931 |
| A513 | 1.160 | -2.763 |
| A514 | 1.014 | -1.881 |
| A515 | 0.539 | -2.291 |
| A516 | 0.480 | 0.478 |
| A517 | 1.997 | -2.332 |
| A518 | 0.422 | -2.484 |
| A519 | 0.793 | -1.969 |
| A520 | 0.412 | -3.122● |
| A521 | 0.723 | -1.941 |
| A522 | 0.460 | -0.658 |
| A523 | 0.094● | 4.638● |
| A524 | 0.494 | -2.058 |
| A525 | 1.132 | -2.004 |
| A526 | 0.994 | -0.843 |
| A527 | 0.099● | -0.402 |
| A528 | 0.481 | -0.100 |
| A529 | 0.604 | -0.574 |
| A530 | 0.708 | -1.754 |
| A531 | 0.033● | 38.517● |
| A532 | 0.577 | 0.032 |
| A533 | 0.893 | -1.824 |
| A534 | 0.923 | -2.166 |
| A535 | 0.714 | -1.336 |
| A536 | 0.748 | -1.136 |
| A537 | 0.542 | -1.364 |
| A538 | 1.330 | -0.974 |
| A539 | 0.801 | -1.029 |
| A540 | 0.477 | -0.692 |
| A541 | 0.594 | -0.902 |
| A542 | 0.505 | -1.465 |
| A543 | 0.548 | -1.130 |
| A544 | 0.907 | -0.491 |
| A545 | 1.003 | -0.661 |
| A546 | 0.363 | 0.346 |
| A547 | 0.324 | -0.395 |
| A548 | 0.533 | -0.116 |

## TABLE 8-4

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.899 | -1.897 |
| A602 | 0.929 | -2.237 |
| A603 | 0.718 | -1.412 |
| A604 | 0.753 | -1.213 |
| A605 | 0.546 | -1.439 |
| A606 | 1.338 | -1.052 |
| A607 | 0.806 | -1.107 |
| A608 | 0.480 | -0.771 |
| A609 | 0.597 | -0.980 |
| A610 | 0.508 | -1.540 |
| A611 | 0.551 | -1.207 |
| A612 | 0.912 | -0.572 |
| A613 | 1.009 | -0.741 |
| A614 | 0.365 | 0.260 |
| A615 | 0.326 | -0.476 |
| A616 | 0.536 | -0.199 |
| A617 | 1.054 | -1.628 |
| A618 | 0.540 | -1.259 |
| A619 | 0.639 | -1.244 |
| A620 | 0.966 | -0.646 |
| A621 | 0.933 | -1.006 |
| A622 | 0.665 | -1.718 |
| A623 | 0.486 | -1.529 |
| A624 | 0.644 | -2.211 |
| A625 | 0.432 | -1.881 |
| A626 | 0.553 | -1.075 |
| A627 | 0.356 | -0.496 |
| A628 | 0.256 | -2.790 |
| A629 | 0.691 | -0.673 |
| A630 | 0.676 | -1.068 |
| A631 | 0.629 | -0.889 |
| A632 | 0.683 | -1.492 |
| A633 | 0.423 | -1.220 |
| A634 | 1.253 | -1.697 |
| A635 | 1.002 | -2.208 |
| A636 | 0.761 | -1.676 |
| A637 | 0.511 | -1.165 |
| A638 | 0.482 | 0.742 |
| A639 | 0.059● | 11.795● |
| A640 | 0.568 | -0.190 |
| A641 | 0.666 | 0.100 |
| A642 | 0.697 | -1.340 |
| A643 | 0.774 | -0.910 |
| A644 | 1.215 | -0.493 |
| A645 | 0.515 | -0.303 |
| A646 | 0.526 | -0.823 |
| A647 | 0.568 | 0.362 |
| A648 | 0.925 | -1.784 |
| A649 | 0.466 | -0.823 |
| A650 | 0.578 | -0.389 |
| A651 | 0.653 | -1.005 |
| A652 | 0.289 | -1.116 |
| A653 | 0.576 | -0.797 |
| A654 | 0.257 | 2.090 |
| A655 | 0.907 | -0.472 |
| A656 | 0.529 | -1.452 |

TABLE 8-5

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.704 | -0.070 |
| J102 | 0.466 | -0.894 |
| J103 | 0.630 | -1.033 |
| J104 | 0.656 | -0.964 |
| J105 | 0.691 | -0.256 |
| J106 | 0.444 | -0.750 |
| J107 | 0.458 | -0.070 |
| J108 | 1.003 | -1.784 |
| J109 | 0.295 | -1.131 |
| J110 | 0.569 | -0.537 |
| J111 | 1.109 | -1.261 |
| J112 | 0.419 | -0.761 |
| J113 | 0.514 | -1.040 |
| J114 | 0.562 | 0.171 |
| J115 | 0.742 | -0.250 |
| J116 | 0.325 | -1.109 |
| J117 | 0.307 | -0.569 |
| J118 | 0.533 | -1.085 |
| J119 | 0.564 | -1.026 |
| J120 | 0.282 | 1.312 |
| J121 | 0.450 | -0.797 |
| J122 | 0.471 | -0.875 |
| J123 | 0.442 | 0.230 |
| J124 | 0.596 | -1.614 |
| J125 | 0.492 | -1.621 |
| J126 | 0.422 | -0.603 |
| J127 | 0.544 | -1.525 |
| J128 | 0.772 | -0.950 |
| J129 | 0.613 | 1.722 |
| J130 | 0.336 | -1.752 |
| J131 | 0.795 | -0.359 |
| J132 | 0.376 | 0.017 |
| J133 | 0.777 | -1.595 |
| J134 | 0.278 | 2.260 |
| J135 | 0.745 | -0.140 |
| J136 | 0.302 | 0.343 |
| J137 | 0.578 | -0.018 |
| J138 | 0.007● | 200.849● |
| J139 | 0.360 | 1.665 |
| J140 | 0.303 | 0.301 |
| J141 | 0.499 | -0.965 |
| J142 | 0.440 | 0.377 |
| J143 | 0.623 | -0.224 |
| J144 | 0.360 | -0.620 |
| J145 | 0.627 | -0.155 |
| J146 | 0.714 | -0.213 |
| J147 | 0.483 | 0.253 |
| J148 | 0.514 | 0.295 |
| J149 | 0.435 | -0.147 |
| J150 | 0.427 | 0.017 |
| J151 | 0.522 | 0.945 |
| J152 | 0.402 | 0.565 |
| J153 | 0.389 | 1.738 |
| J154 | 0.343 | 1.409 |
| J155 | 0.801 | 1.066 |
| J156 | 0.744 | 1.538 |

## TABLE 8-6

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.566 | 0.005 |
| J202 | 0.007● | 205.179● |
| J203 | 0.352 | 1.724 |
| J204 | 0.297 | 0.332 |
| J205 | 0.488 | -0.962 |
| J206 | 0.431 | 0.409 |
| J207 | 0.610 | -0.205 |
| J208 | 0.353 | -0.609 |
| J209 | 0.614 | -0.134 |
| J210 | 0.699 | -0.193 |
| J211 | 0.472 | 0.282 |
| J212 | 0.503 | 0.325 |
| J213 | 0.426 | -0.126 |
| J214 | 0.418 | 0.042 |
| J215 | 0.511 | 0.989 |
| J216 | 0.393 | 0.601 |
| J217 | 0.381 | 1.799 |
| J218 | 0.336 | 1.463 |
| J219 | 0.784 | 1.113 |
| J220 | 0.729 | 1.595 |
| J221 | 0.331 | 1.952 |
| J222 | 0.543 | 0.619 |
| J223 | 0.360 | -0.477 |
| J224 | 0.531 | 0.604 |
| J225 | 0.576 | -0.047 |
| J226 | 0.517 | 0.636 |
| J227 | 0.520 | 0.199 |
| J228 | 0.562 | -0.224 |
| J229 | 0.538 | 0.126 |
| J230 | 0.473 | 0.145 |
| J231 | 1.209 | -0.013 |
| J232 | 0.774 | -0.148 |
| J233 | 0.236 | 2.283 |
| J234 | 0.274 | 1.531 |
| J235 | 0.790 | 0.641 |
| J236 | 0.720 | 0.771 |
| J237 | 0.209 | -0.072 |
| J238 | 0.610 | 2.529 |
| J239 | 0.391 | 1.211 |
| J240 | 0.479 | 1.849 |
| J241 | 0.924 | -0.013 |
| J242 | 0.624 | 0.272 |
| J243 | 0.305 | 0.469 |
| J244 | 0.224 | 1.025 |
| J245 | 0.634 | 1.300 |
| J246 | 0.203 | 1.680 |
| J247 | 0.388 | 1.201 |
| J248 | 0.309 | -0.756 |
| J249 | 0.531 | 1.076 |
| J250 | 0.544 | 0.963 |
| J251 | 0.744 | 0.259 |
| J252 | 0.399 | 1.424 |
| J253 | 0.439 | 1.498 |
| J254 | 0.438 | 1.446 |
| J255 | 0.838 | 1.530 |
| J256 | 0.389 | 2.191 |
| J257 | 0.407 | 1.087 |
| J258 | 0.314 | 1.643 |
| J259 | 0.599 | 1.747 |
| J260 | 0.089● | 3.160● |

TABLE 8-7

**Readjusted Estimated Item Discrimination Parameter $a_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A501 | 0.837 | -2.316 |
| A502 | 0.582 | -3.287● |
| A503 | 0.664 | -3.422● |
| A504 | 0.700 | -2.070 |
| A505 | 0.886 | -2.399 |
| A506 | 0.523 | -2.055 |
| A507 | 0.558 | -0.967 |
| A508 | 0.863 | -1.856 |
| A509 | 1.604 | -1.967 |
| A510 | 0.721 | -0.955 |
| A511 | 0.542 | -2.180 |
| A512 | 0.772 | -1.937 |
| A513 | 1.154 | -2.772 |
| A514 | 1.008 | -1.886 |
| A515 | 0.535 | -2.300 |
| A516 | 0.477 | 0.488 |
| A517 | 1.978 | -2.340 |
| A518 | 0.419 | -2.492 |
| A519 | 0.790 | -1.973 |
| A520 | 0.409 | -3.135● |
| A521 | 0.719 | -1.946 |
| A522 | 0.457 | -0.656 |
| A523 | 0.092● | 4.754● |
| A524 | 0.490 | -2.065 |
| A525 | 1.127 | -2.008 |
| A526 | 0.987 | -0.842 |
| A527 | 0.100 | -0.405 |
| A528 | 0.477 | -0.094 |
| A529 | 0.601 | -0.572 |
| A530 | 0.701 | -1.761 |
| A531 | 0.030● | 42.338● |
| A532 | 0.574 | 0.038 |
| A533 | 0.900 | -1.817 |
| A534 | 0.932 | -2.155 |
| A535 | 0.721 | -1.332 |
| A536 | 0.762 | -1.133 |
| A537 | 0.549 | -1.360 |
| A538 | 1.341 | -0.972 |
| A539 | 0.810 | -1.029 |
| A540 | 0.485 | -0.697 |
| A541 | 0.606 | -0.902 |
| A542 | 0.513 | -1.457 |
| A543 | 0.558 | -1.127 |
| A544 | 0.919 | -0.497 |
| A545 | 1.016 | -0.664 |
| A546 | 0.367 | 0.327 |
| A547 | 0.329 | -0.406 |
| A548 | 0.543 | -0.132 |

## TABLE 8-8

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0699, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| A601 | 0.852 | -1.968 |
| A602 | 0.882 | -2.325 |
| A603 | 0.682 | -1.456 |
| A604 | 0.721 | -1.245 |
| A605 | 0.520 | -1.485 |
| A606 | 1.269 | -1.075 |
| A607 | 0.766 | -1.135 |
| A608 | 0.459 | -0.784 |
| A609 | 0.574 | -1.001 |
| A610 | 0.485 | -1.588 |
| A611 | 0.528 | -1.239 |
| A612 | 0.869 | -0.573 |
| A613 | 0.961 | -0.749 |
| A614 | 0.347 | 0.298 |
| A615 | 0.312 | -0.477 |
| A616 | 0.514 | -0.187 |
| A617 | 1.035 | -1.654 |
| A618 | 0.523 | -1.288 |
| A619 | 0.629 | -1.262 |
| A620 | 0.962 | -0.651 |
| A621 | 0.904 | -1.023 |
| A622 | 0.648 | -1.751 |
| A623 | 0.475 | -1.558 |
| A624 | 0.631 | -2.251 |
| A625 | 0.423 | -1.914 |
| A626 | 0.542 | -1.091 |
| A627 | 0.352 | -0.502 |
| A628 | 0.252 | -2.839 |
| A629 | 0.670 | -0.683 |
| A630 | 0.664 | -1.083 |
| A631 | 0.617 | -0.901 |
| A632 | 0.671 | -1.515 |
| A633 | 0.415 | -1.239 |
| A634 | 1.220 | -1.728 |
| A635 | 0.983 | -2.245 |
| A636 | 0.743 | -1.706 |
| A637 | 0.501 | -1.184 |
| A638 | 0.475 | 0.753 |
| A639 | 0.061● | 11.324● |
| A640 | 0.552 | -0.188 |
| A641 | 0.803 | -0.028 |
| A642 | 0.513 | -1.019 |
| A643 | 0.753 | -0.872 |
| A644 | 0.933 | -0.633 |
| A645 | 0.708 | -0.267 |
| A646 | 0.513 | -0.694 |
| A647 | 0.587 | 0.066 |
| A648 | 1.048 | -1.636 |
| A649 | 0.385 | -0.861 |
| A650 | 0.655 | -0.436 |
| A651 | 1.045 | -1.066 |
| A652 | 0.421 | -0.801 |
| A653 | 0.615 | -0.834 |
| A654 | 0.586 | 0.321 |
| A655 | 0.851 | -0.281 |
| A656 | 0.369 | -1.205 |

## TABLE 8-9

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.678 | -0.042 |
| J102 | 0.433 | -1.217 |
| J103 | 0.636 | -1.042 |
| J104 | 0.787 | -0.758 |
| J105 | 0.598 | -0.325 |
| J106 | 0.433 | -0.832 |
| J107 | 0.495 | 0.069 |
| J108 | 0.884 | -1.947 |
| J109 | 0.325 | -1.029 |
| J110 | 0.553 | -0.525 |
| J111 | 0.882 | -1.272 |
| J112 | 0.356 | -0.958 |
| J113 | 0.519 | -0.997 |
| J114 | 0.495 | 0.372 |
| J115 | 0.718 | -0.341 |
| J116 | 0.312 | -1.436 |
| J117 | 0.314 | -0.548 |
| J118 | 0.545 | -1.053 |
| J119 | 0.578 | -0.993 |
| J120 | 0.287 | 1.294 |
| J121 | 0.461 | -0.771 |
| J122 | 0.480 | -0.850 |
| J123 | 0.454 | 0.233 |
| J124 | 0.609 | -1.570 |
| J125 | 0.504 | -1.574 |
| J126 | 0.431 | -0.582 |
| J127 | 0.557 | -1.482 |
| J128 | 0.789 | -0.922 |
| J129 | 0.628 | 1.691 |
| J130 | 0.343 | -1.710 |
| J131 | 0.812 | -0.343 |
| J132 | 0.383 | 0.024 |
| J133 | 0.791 | -1.558 |
| J134 | 0.285 | 2.216 |
| J135 | 0.763 | -0.128 |
| J136 | 0.308 | 0.344 |
| J137 | 0.593 | -0.010 |
| J138 | 0.007● | 222.009● |
| J139 | 0.369 | 1.629 |
| J140 | 0.310 | 0.300 |
| J141 | 0.512 | -0.934 |
| J142 | 0.451 | 0.375 |
| J143 | 0.639 | -0.210 |
| J144 | 0.370 | -0.597 |
| J145 | 0.643 | -0.143 |
| J146 | 0.735 | -0.198 |
| J147 | 0.494 | 0.253 |
| J148 | 0.527 | 0.295 |
| J149 | 0.448 | -0.133 |
| J150 | 0.438 | 0.024 |
| J151 | 0.536 | 0.928 |
| J152 | 0.413 | 0.558 |
| J153 | 0.400 | 1.699 |
| J154 | 0.352 | 1.380 |
| J155 | 0.824 | 1.047 |
| J156 | 0.767 | 1.505 |

TABLE 8-10

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J201 | 0.563 | 0.004 |
| J202 | 0.006● | 233.498● |
| J203 | 0.351 | 1.728 |
| J204 | 0.295 | 0.330 |
| J205 | 0.487 | -0.967 |
| J206 | 0.429 | 0.409 |
| J207 | 0.608 | -0.207 |
| J208 | 0.352 | -0.613 |
| J209 | 0.612 | -0.136 |
| J210 | 0.698 | -0.194 |
| J211 | 0.470 | 0.281 |
| J212 | 0.501 | 0.325 |
| J213 | 0.426 | -0.126 |
| J214 | 0.417 | 0.040 |
| J215 | 0.510 | 0.991 |
| J216 | 0.392 | 0.601 |
| J217 | 0.381 | 1.801 |
| J218 | 0.335 | 1.466 |
| J219 | 0.783 | 1.116 |
| J220 | 0.729 | 1.598 |
| J221 | 0.332 | 1.950 |
| J222 | 0.543 | 0.617 |
| J223 | 0.361 | -0.475 |
| J224 | 0.532 | 0.604 |
| J225 | 0.578 | -0.045 |
| J226 | 0.519 | 0.636 |
| J227 | 0.520 | 0.198 |
| J228 | 0.563 | -0.223 |
| J229 | 0.539 | 0.127 |
| J230 | 0.473 | 0.145 |
| J231 | 1.210 | -0.012 |
| J232 | 0.776 | -0.147 |
| J233 | 0.237 | 2.280 |
| J234 | 0.275 | 1.529 |
| J235 | 0.792 | 0.641 |
| J236 | 0.720 | 0.770 |
| J237 | 0.210 | -0.068 |
| J238 | 0.610 | 2.526 |
| J239 | 0.391 | 1.209 |
| J240 | 0.479 | 1.847 |
| J241 | 0.929 | -0.011 |
| J242 | 0.625 | 0.272 |
| J243 | 0.304 | 0.467 |
| J244 | 0.224 | 1.023 |
| J245 | 0.635 | 1.299 |
| J246 | 0.202 | 1.679 |
| J247 | 0.389 | 1.200 |
| J248 | 0.310 | -0.756 |
| J249 | 0.530 | 1.075 |
| J250 | 0.545 | 0.962 |
| J251 | 0.746 | 0.259 |
| J252 | 0.400 | 1.422 |
| J253 | 0.439 | 1.497 |
| J254 | 0.438 | 1.444 |
| J255 | 0.838 | 1.529 |
| J256 | 0.390 | 2.188 |
| J257 | 0.408 | 1.086 |
| J258 | 0.315 | 1.641 |
| J259 | 0.600 | 1.746 |
| J260 | 0.088● | 3.176● |

TABLE 8-11

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model.

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.698 | -0.071 |
| J102 | 0.464 | -0.897 |
| J103 | 0.628 | -1.037 |
| J104 | 0.653 | -0.967 |
| J105 | 0.690 | -0.257 |
| J106 | 0.443 | -0.750 |
| J107 | 0.456 | -0.069 |
| J108 | 1.006 | -1.783 |
| J109 | 0.295 | -1.127 |
| J110 | 0.573 | -0.534 |
| J111 | 1.109 | -1.264 |
| J112 | 0.416 | -0.767 |
| J113 | 0.510 | -1.049 |
| J114 | 0.559 | 0.172 |
| J115 | 0.742 | -0.251 |
| J116 | 0.322 | -1.119 |
| J117 | 0.306 | -0.570 |
| J118 | 0.528 | -1.094 |
| J119 | 0.561 | -1.031 |
| J120 | 0.280 | 1.322 |
| J121 | 0.450 | -0.796 |
| J122 | 0.469 | -0.878 |
| J123 | 0.440 | 0.232 |
| J124 | 0.595 | -1.617 |
| J125 | 0.493 | -1.619 |
| J126 | 0.420 | -0.604 |
| J127 | 0.541 | -1.532 |
| J128 | 0.771 | -0.953 |
| J129 | 0.609 | 1.735 |
| J130 | 0.337 | -1.750 |
| J131 | 0.794 | -0.361 |
| J132 | 0.372 | 0.017 |
| J133 | 0.784 | -1.588 |
| J134 | 0.274 | 2.292 |
| J135 | 0.744 | -0.140 |
| J136 | 0.300 | 0.347 |
| J137 | 0.576 | 0.094 |
| J138 | --- | --- |
| J139 | 0.378 | 1.441 |
| J140 | 0.348 | 0.287 |
| J141 | 0.535 | -0.934 |
| J142 | 0.420 | 0.430 |
| J143 | 0.621 | -0.217 |
| J144 | 0.329 | -0.534 |
| J145 | 0.681 | -0.306 |
| J146 | 0.758 | -0.090 |
| J147 | 0.413 | 0.286 |
| J148 | 0.444 | 0.436 |
| J149 | 0.446 | -0.225 |
| J150 | 0.441 | -0.100 |
| J151 | 0.409 | 1.039 |
| J152 | 0.323 | 0.661 |
| J153 | 0.417 | 1.619 |
| J154 | 0.206 | 2.247 |
| J155 | 0.763 | 1.139 |
| J156 | 0.653 | 1.564 |

## TABLE 8-12

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ | $\hat{c}_g$ |
|---|---|---|---|
| J101 | 0.915 | 0.309 | 0.146 |
| J102 | 0.488 | -0.550 | 0.143 |
| J103 | 0.652 | -0.750 | 0.143 |
| J104 | 0.708 | -0.657 | 0.143 |
| J105 | 0.857 | 0.100 | 0.137 |
| J106 | 0.497 | -0.316 | 0.143 |
| J107 | 0.563 | 0.367 | 0.143 |
| J108 | 0.839 | -1.935 | 0.143 |
| J109 | 0.317 | -0.574 | 0.143 |
| J110 | 0.648 | -0.159 | 0.143 |
| J111 | 1.066 | -1.147 | 0.143 |
| J112 | 0.446 | -0.350 | 0.143 |
| J113 | 0.525 | -0.731 | 0.143 |
| J114 | 1.066 | 0.797 | 0.234 |
| J115 | 0.982 | 0.182 | 0.173 |
| J116 | 0.349 | -0.606 | 0.143 |
| J117 | 0.341 | 0.006 | 0.143 |
| J118 | 0.531 | -0.803 | 0.143 |
| J119 | 0.586 | -0.724 | 0.143 |
| J120 | 1.000 | 1.882 | 0.278 |
| J121 | 0.484 | -0.398 | 0.143 |
| J122 | 0.499 | -0.500 | 0.143 |
| J123 | 0.578 | 0.676 | 0.143 |
| J124 | 0.563 | -1.482 | 0.143 |
| J125 | 0.485 | -1.405 | 0.143 |
| J126 | 0.471 | -0.151 | 0.143 |
| J127 | 0.527 | -1.343 | 0.143 |
| J128 | 0.800 | -0.700 | 0.143 |
| J129 | 0.747 | 1.641 | 0.018 |
| J130 | 0.334 | -1.388 | 0.143 |
| J131 | 1.100 | 0.101 | 0.191 |
| J132 | 0.460 | 0.535 | 0.143 |
| J133 | 0.754 | -1.472 | 0.143 |
| J134 | 0.582 | 2.370 | 0.162 |
| J135 | 0.765 | -0.019 | 0.041 |
| J136 | 0.375 | 0.923 | 0.143 |
| J137 | 0.744 | 0.459 | 0.131 |
| J138 | --- | --- | --- |
| J139 | 1.107 | 1.745 | 0.213 |
| J140 | 0.547 | 1.053 | 0.218 |
| J141 | 0.553 | -0.617 | 0.143 |
| J142 | 0.849 | 1.130 | 0.245 |
| J143 | 0.914 | 0.323 | 0.201 |
| J144 | 0.374 | 0.015 | 0.143 |
| J145 | 0.749 | -0.045 | 0.103 |
| J146 | 0.873 | 0.145 | 0.087 |
| J147 | 1.432 | 1.241 | 0.338 |
| J148 | 0.742 | 1.041 | 0.207 |
| J149 | 0.530 | 0.226 | 0.143 |
| J150 | 0.521 | 0.352 | 0.143 |
| J151 | 0.737 | 1.483 | 0.181 |
| J152 | 1.154 | 1.612 | 0.331 |
| J153 | 1.037 | 1.764 | 0.167 |
| J154 | 0.634 | 2.587 | 0.249 |
| J155 | 1.466 | 1.232 | 0.089 |
| J156 | 1.320 | 1.544 | 0.086 |

## TABLE 8-13

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ |
|---|---|---|
| J101 | 0.715 | -0.247 |
| J102 | 0.514 | -0.983 |
| J103 | 0.582 | -1.238 |
| J104 | 0.719 | -0.812 |
| J105 | 0.793 | -0.104 |
| J106 | 0.480 | -0.746 |
| J107 | 0.551 | 0.212 |
| J108 | 0.915 | -1.839 |
| J109 | 0.361 | -0.893 |
| J110 | 0.553 | -0.336 |
| J111 | 1.080 | -1.231 |
| J112 | 0.410 | -1.081 |
| J113 | 0.494 | -1.085 |
| J114 | 0.456 | 0.490 |
| J115 | 0.698 | -0.240 |
| J116 | 0.283 | -1.721 |
| J117 | 0.372 | -0.626 |
| J118 | 0.617 | -1.523 |
| J119 | 0.659 | -0.979 |
| J120 | 0.274 | 1.072 |
| J121 | 0.469 | -0.879 |
| J122 | 0.442 | -1.040 |
| J123 | 0.431 | 0.147 |
| J124 | 0.581 | -1.278 |
| J125 | 0.457 | -1.645 |
| J126 | 0.350 | -0.414 |
| J127 | 0.537 | -1.274 |
| J128 | 0.708 | -1.083 |
| J129 | 0.708 | 1.519 |
| J130 | 0.364 | -1.728 |
| J131 | 0.806 | -0.509 |
| J132 | 0.310 | 0.186 |
| J133 | 0.898 | -1.343 |
| J134 | 0.279 | 1.676 |
| J135 | 0.858 | -0.240 |
| J136 | 0.339 | 0.286 |
| J137 | 0.567 | 0.329 |
| J138 | --- | --- |
| J139 | 0.372 | 1.573 |
| J140 | 0.389 | 0.221 |
| J141 | 0.545 | -0.716 |
| J142 | 0.433 | 0.132 |
| J143 | 0.577 | -0.106 |
| J144 | 0.352 | -0.437 |
| J145 | 0.609 | -0.508 |
| J146 | 0.868 | 0.039 |
| J147 | 0.339 | 0.375 |
| J148 | 0.487 | -0.080 |
| J149 | 0.468 | -0.122 |
| J150 | 0.503 | -0.047 |
| J151 | 0.440 | 0.903 |
| J152 | 0.374 | 0.465 |
| J153 | 0.404 | 1.946 |
| J154 | 0.238 | 2.266 |
| J155 | 0.741 | 1.289 |
| J156 | 0.690 | 1.463 |

TABLE 8-14

**Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2250 Case, Assuming the Three-Parameter Logistic Model.**

| Item | $\hat{a}_g$ | $\hat{b}_g$ | $\hat{c}_g$ |
|---|---|---|---|
| J101 | 0.888 | 0.092 | 0.151 |
| J102 | 0.534 | -0.694 | 0.146 |
| J103 | 0.598 | -0.989 | 0.146 |
| J104 | 0.788 | -0.540 | 0.146 |
| J105 | 0.960 | 0.136 | 0.109 |
| J106 | 0.529 | -0.374 | 0.146 |
| J107 | 0.680 | 0.485 | 0.109 |
| J108 | 0.795 | -1.959 | 0.146 |
| J109 | 0.394 | -0.433 | 0.146 |
| J110 | 0.661 | 0.044 | 0.146 |
| J111 | 1.042 | -1.144 | 0.146 |
| J112 | 0.427 | -0.718 | 0.146 |
| J113 | 0.516 | -0.774 | 0.146 |
| J114 | 0.932 | 1.103 | 0.245 |
| J115 | 0.886 | 0.151 | 0.172 |
| J116 | 0.301 | -1.191 | 0.146 |
| J117 | 0.412 | -0.157 | 0.146 |
| J118 | 0.589 | -1.402 | 0.146 |
| J119 | 0.695 | -0.720 | 0.146 |
| J120 | 0.530 | 1.769 | 0.229 |
| J121 | 0.497 | -0.536 | 0.146 |
| J122 | 0.461 | -0.692 | 0.146 |
| J123 | 0.540 | 0.579 | 0.146 |
| J124 | 0.580 | -1.057 | 0.146 |
| J125 | 0.456 | -1.409 | 0.146 |
| J126 | 0.402 | 0.097 | 0.146 |
| J127 | 0.538 | -1.047 | 0.146 |
| J128 | 0.716 | -0.887 | 0.146 |
| J129 | 0.821 | 1.448 | 0.013 |
| J130 | 0.360 | -1.419 | 0.146 |
| J131 | 0.987 | -0.149 | 0.178 |
| J132 | 0.383 | 0.749 | 0.146 |
| J133 | 0.898 | -1.208 | 0.146 |
| J134 | 0.427 | 2.048 | 0.146 |
| J135 | 0.938 | -0.067 | 0.085 |
| J136 | 0.426 | 0.797 | 0.146 |
| J137 | 0.713 | 0.592 | 0.108 |
| J138 | --- | --- | --- |
| J139 | 0.933 | 1.762 | 0.193 |
| J140 | 0.493 | 0.688 | 0.146 |
| J141 | 0.583 | -0.395 | 0.146 |
| J142 | 0.793 | 0.903 | 0.267 |
| J143 | 0.849 | 0.425 | 0.209 |
| J144 | 0.395 | 0.059 | 0.146 |
| J145 | 0.674 | -0.189 | 0.146 |
| J146 | 1.070 | 0.258 | 0.101 |
| J147 | 1.458 | 1.407 | 0.373 |
| J148 | 0.592 | 0.325 | 0.146 |
| J149 | 0.556 | 0.286 | 0.146 |
| J150 | 0.612 | 0.348 | 0.146 |
| J151 | 0.758 | 1.320 | 0.182 |
| J152 | 0.952 | 1.325 | 0.308 |
| J153 | 1.227 | 1.784 | 0.156 |
| J154 | 0.628 | 2.398 | 0.212 |
| J155 | 1.396 | 1.294 | 0.085 |
| J156 | 1.474 | 1.426 | 0.095 |

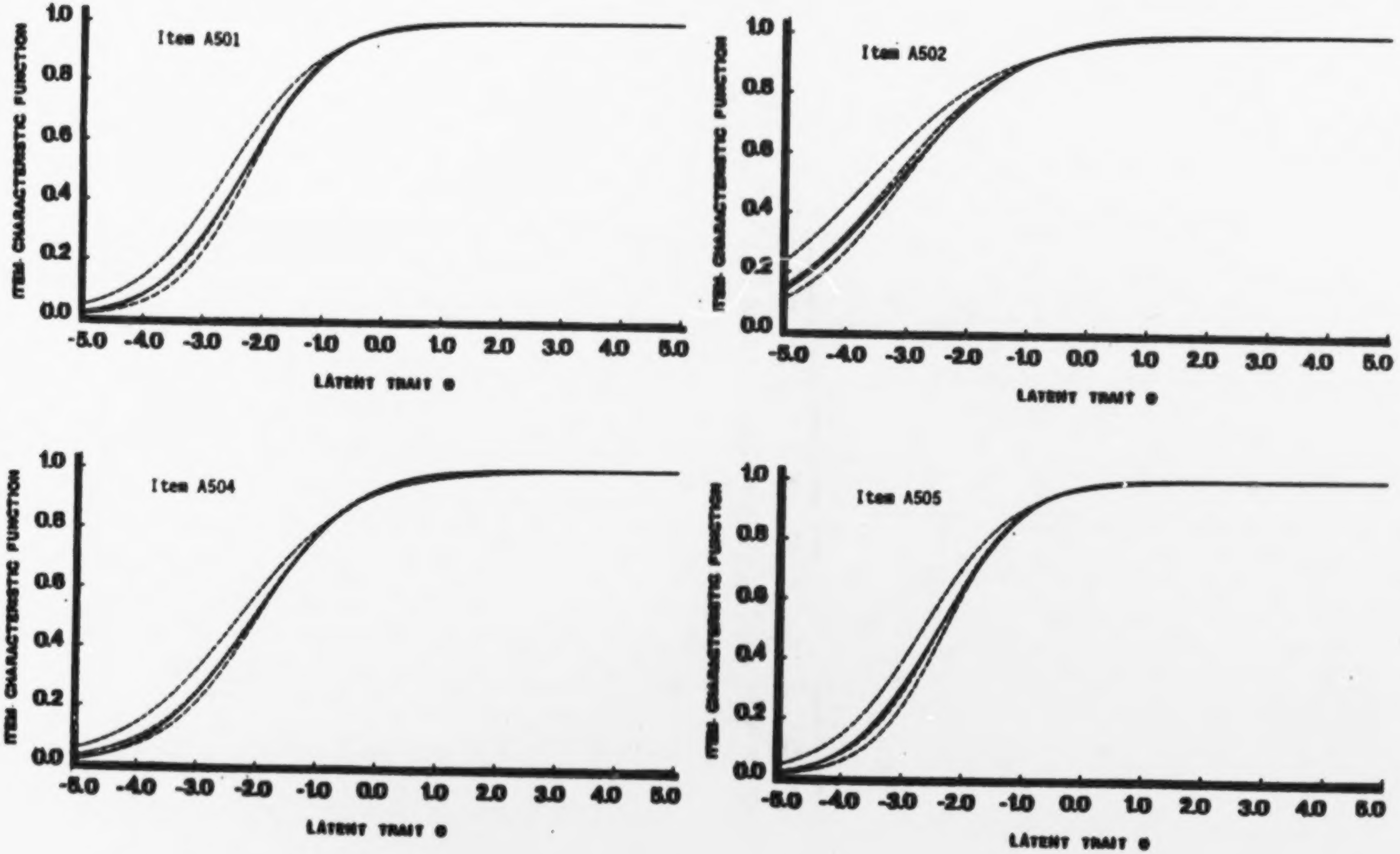

FIGURE 9-1

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the A5-A6 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test A5.

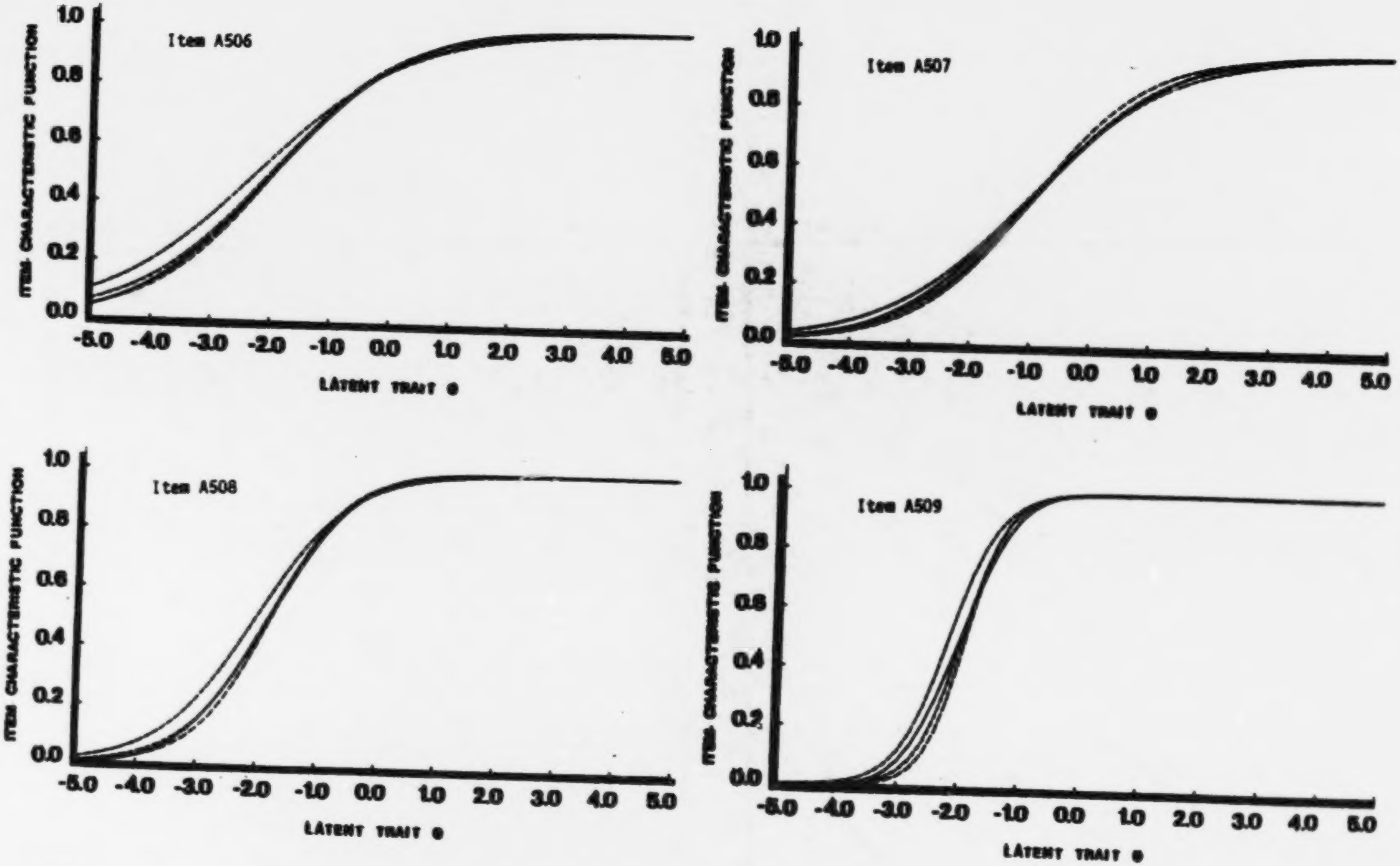

FIGURE 9-1 (Continued)

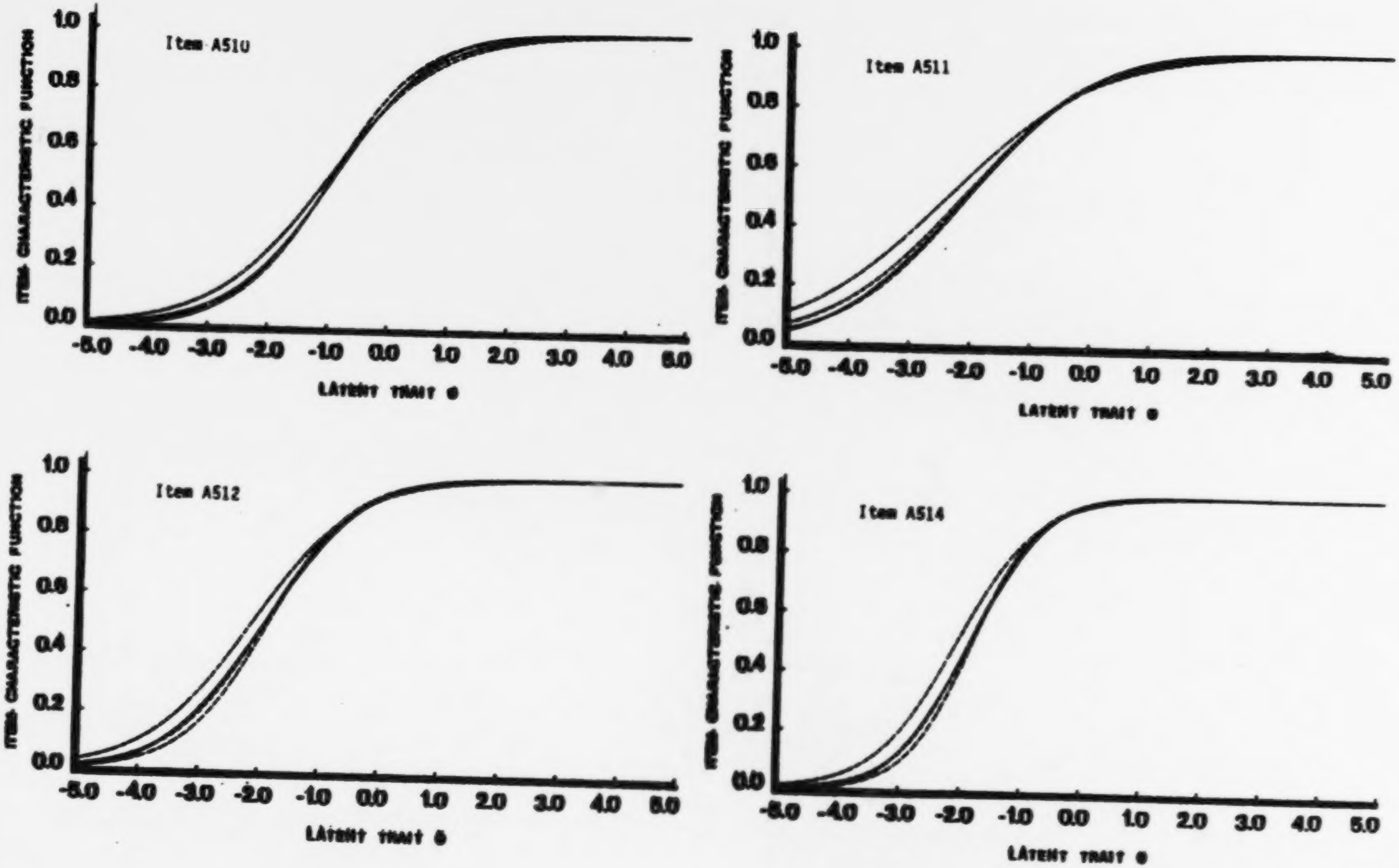

FIGURE 9-1 (Continued)

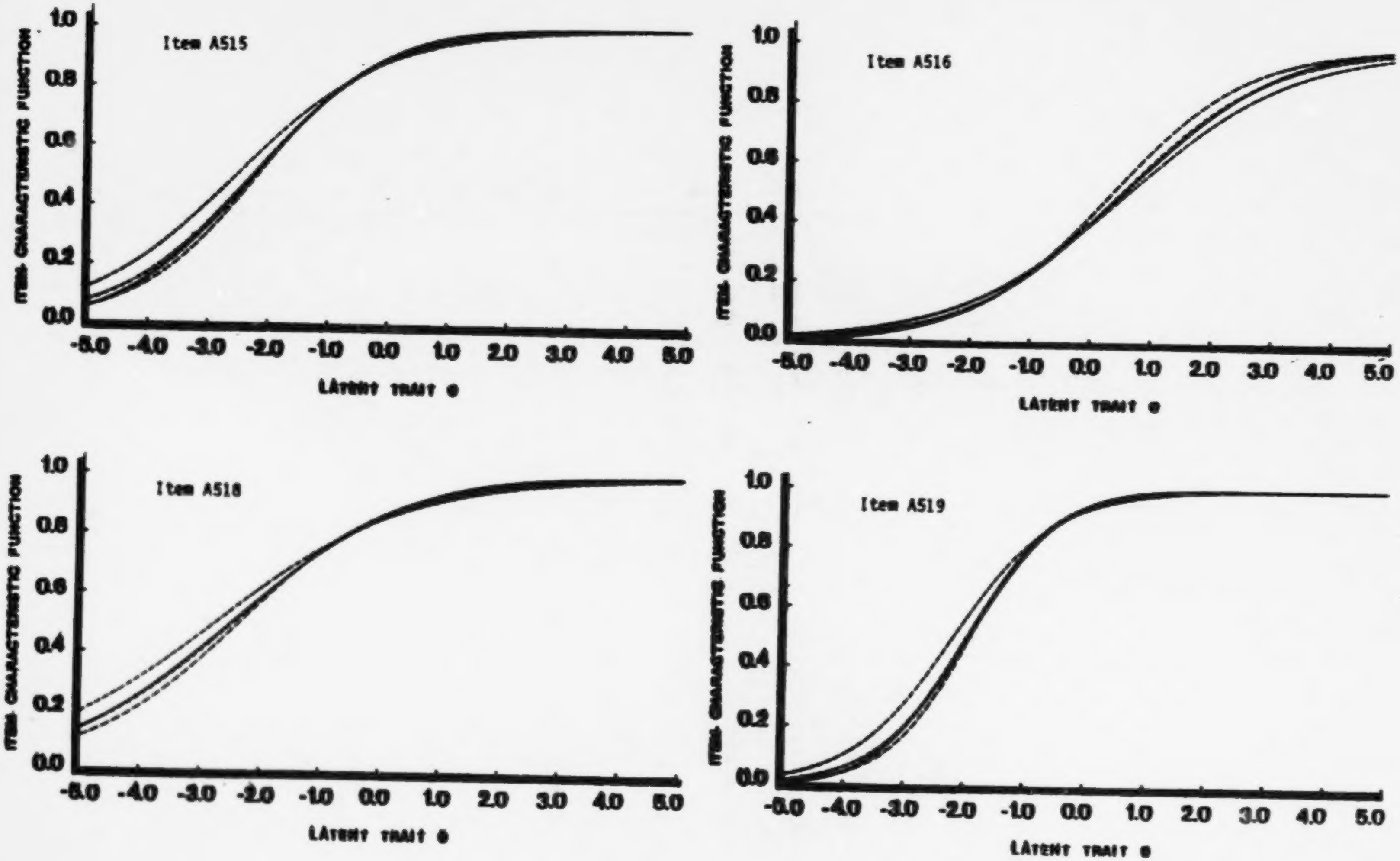

FIGURE 9-1 (Continued)

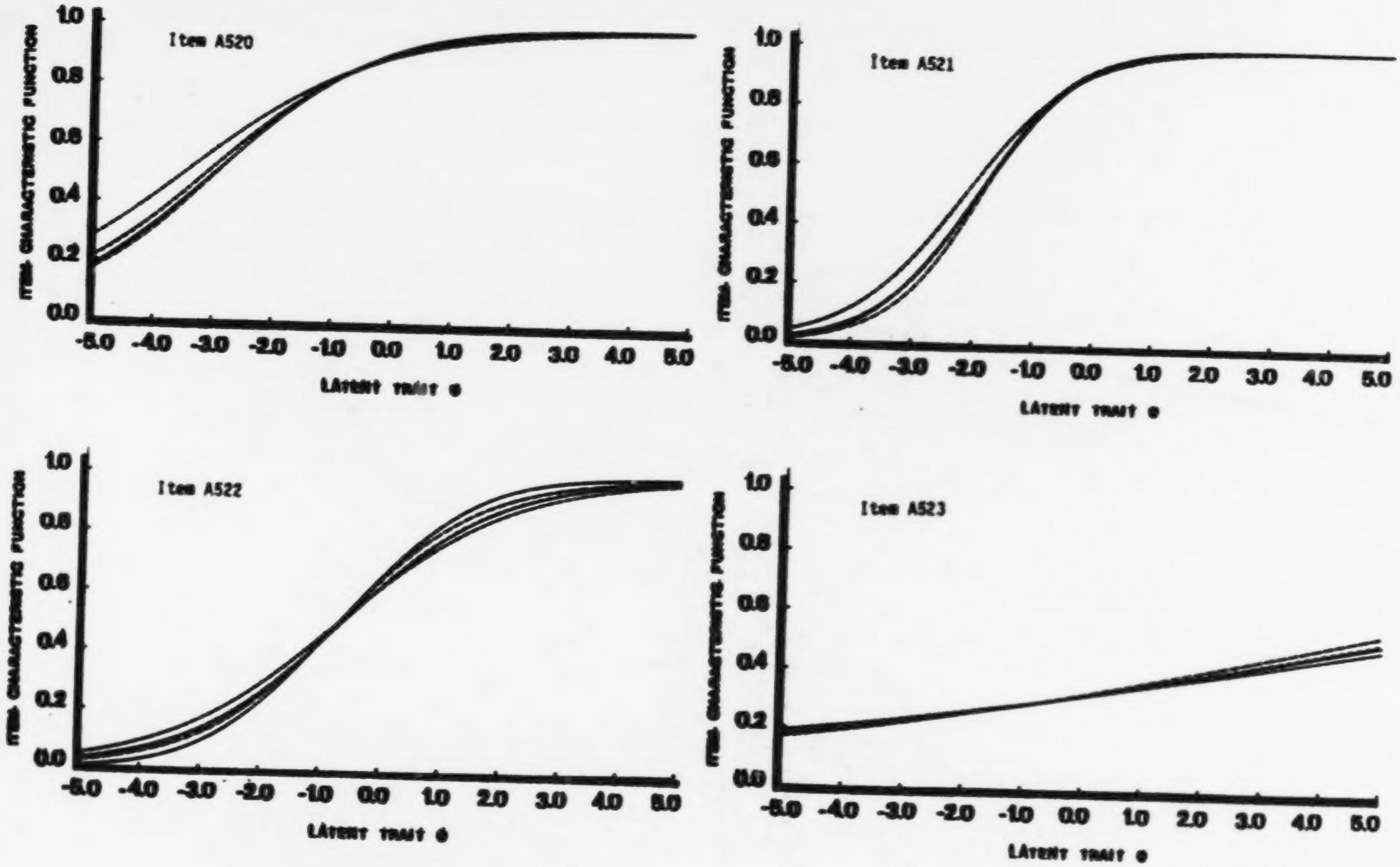

FIGURE 9-1 (Continued)

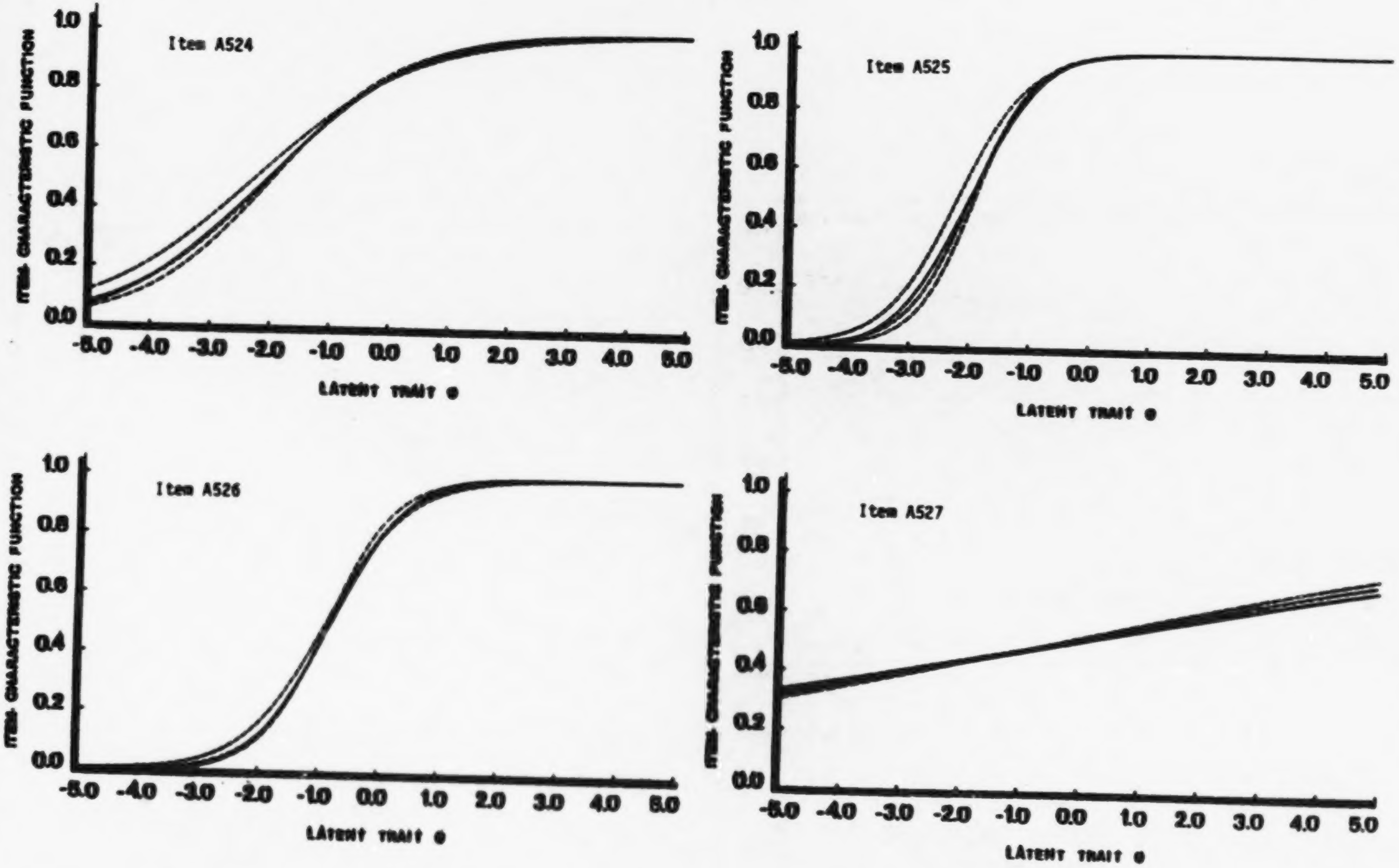

FIGURE 9-1 (Continued)

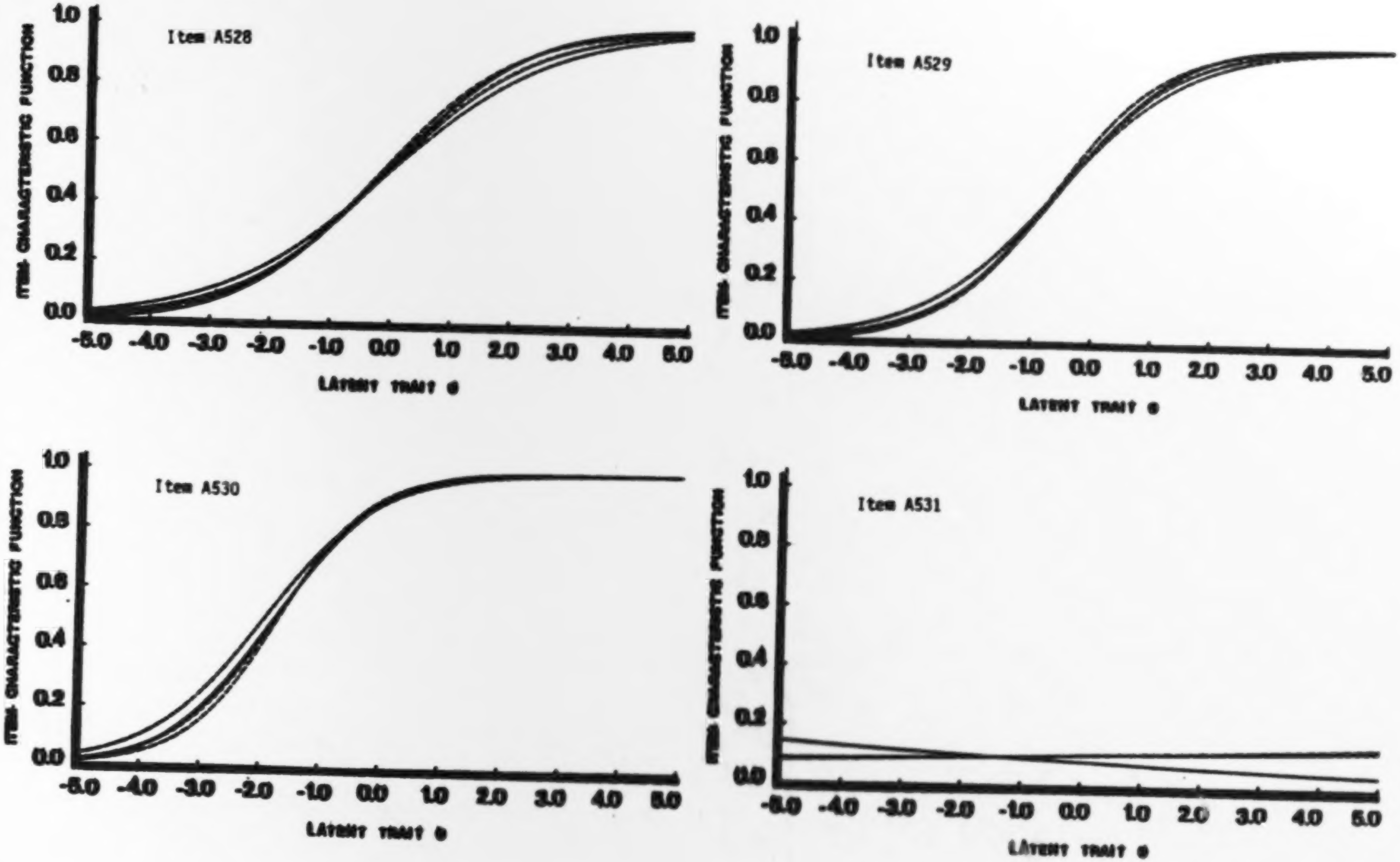

FIGURE 9-1 (Continued)

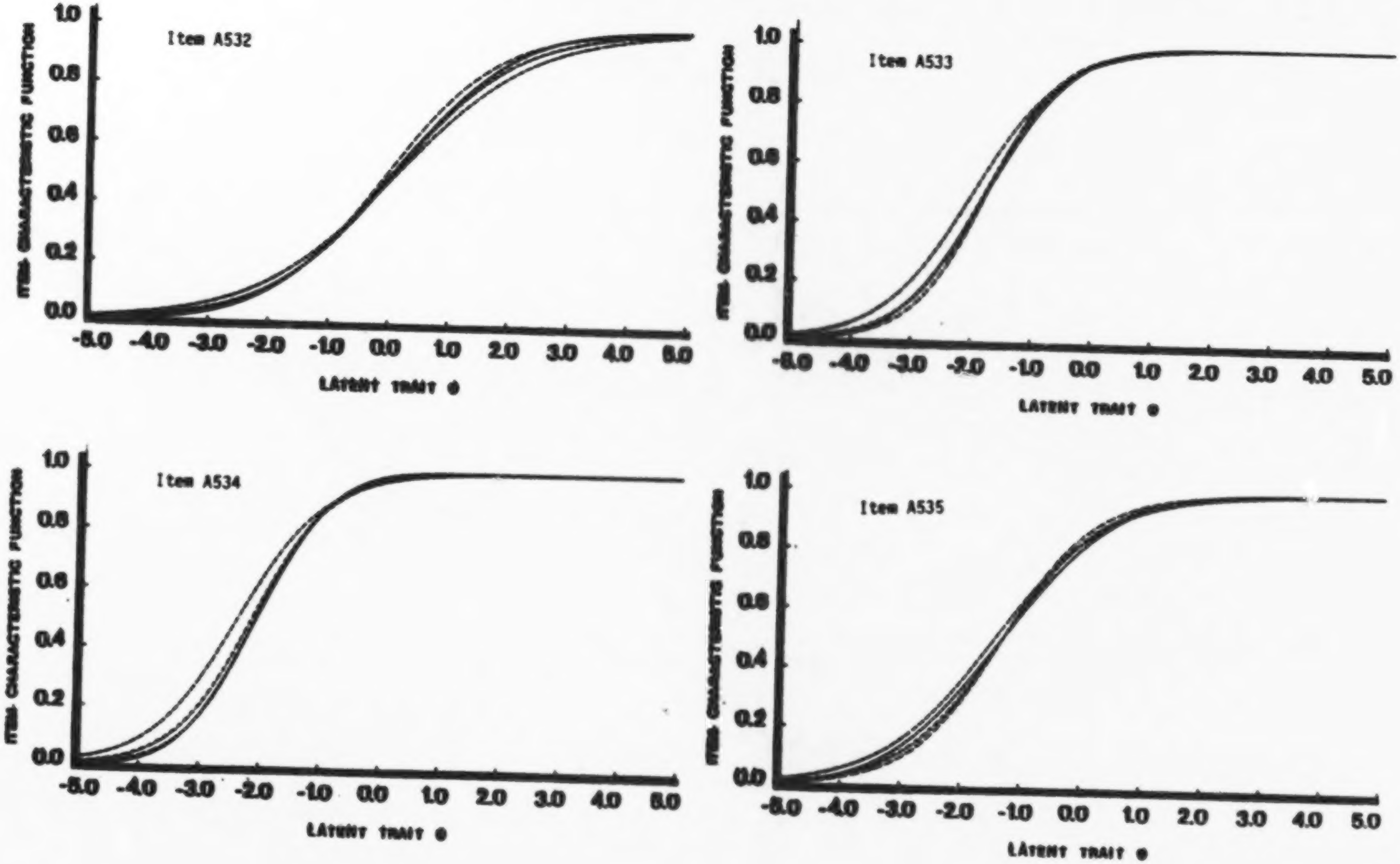

FIGURE 9-1 (Continued)

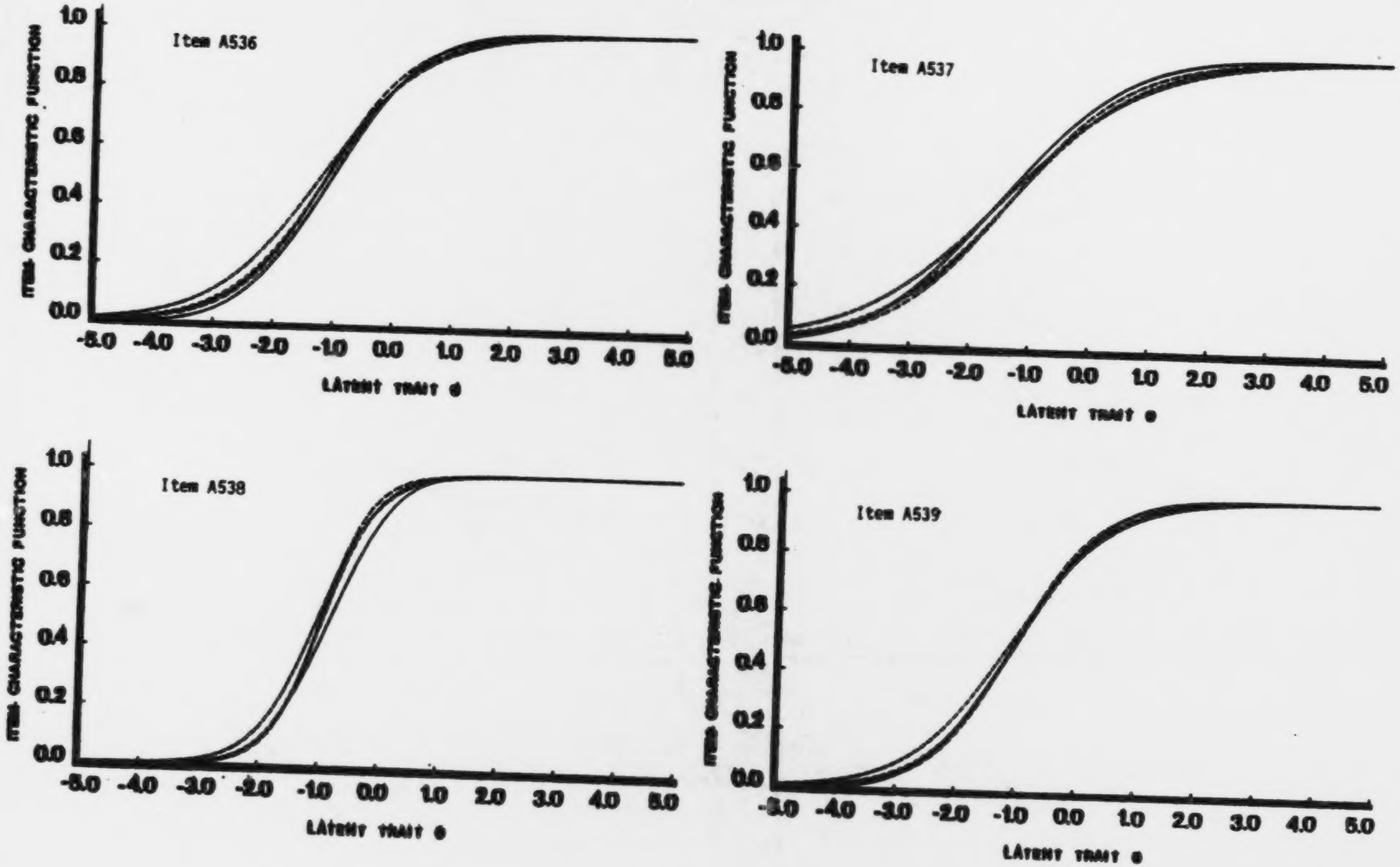

FIGURE 9-1 (Continued)

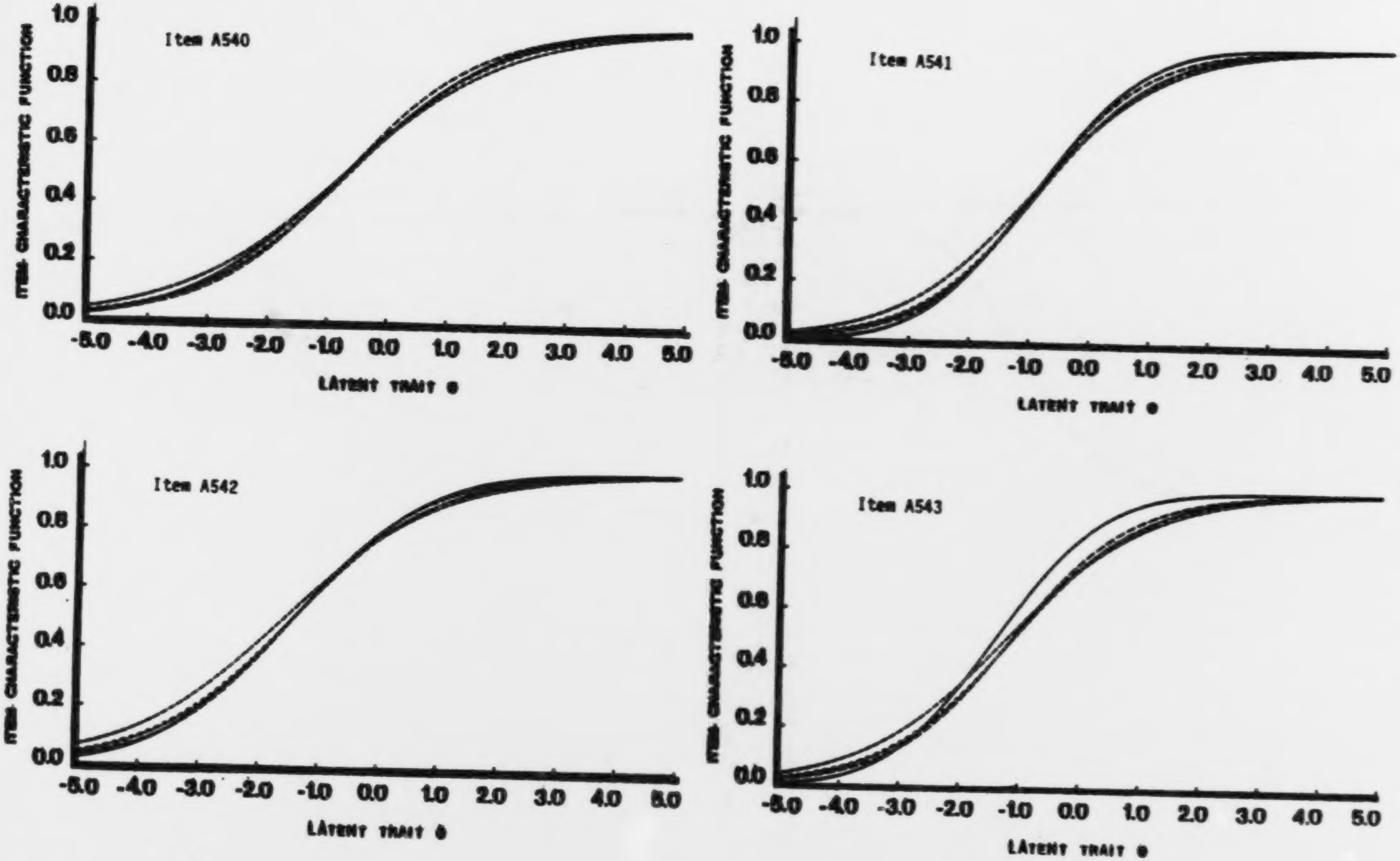

FIGURE 9-1 (Continued)

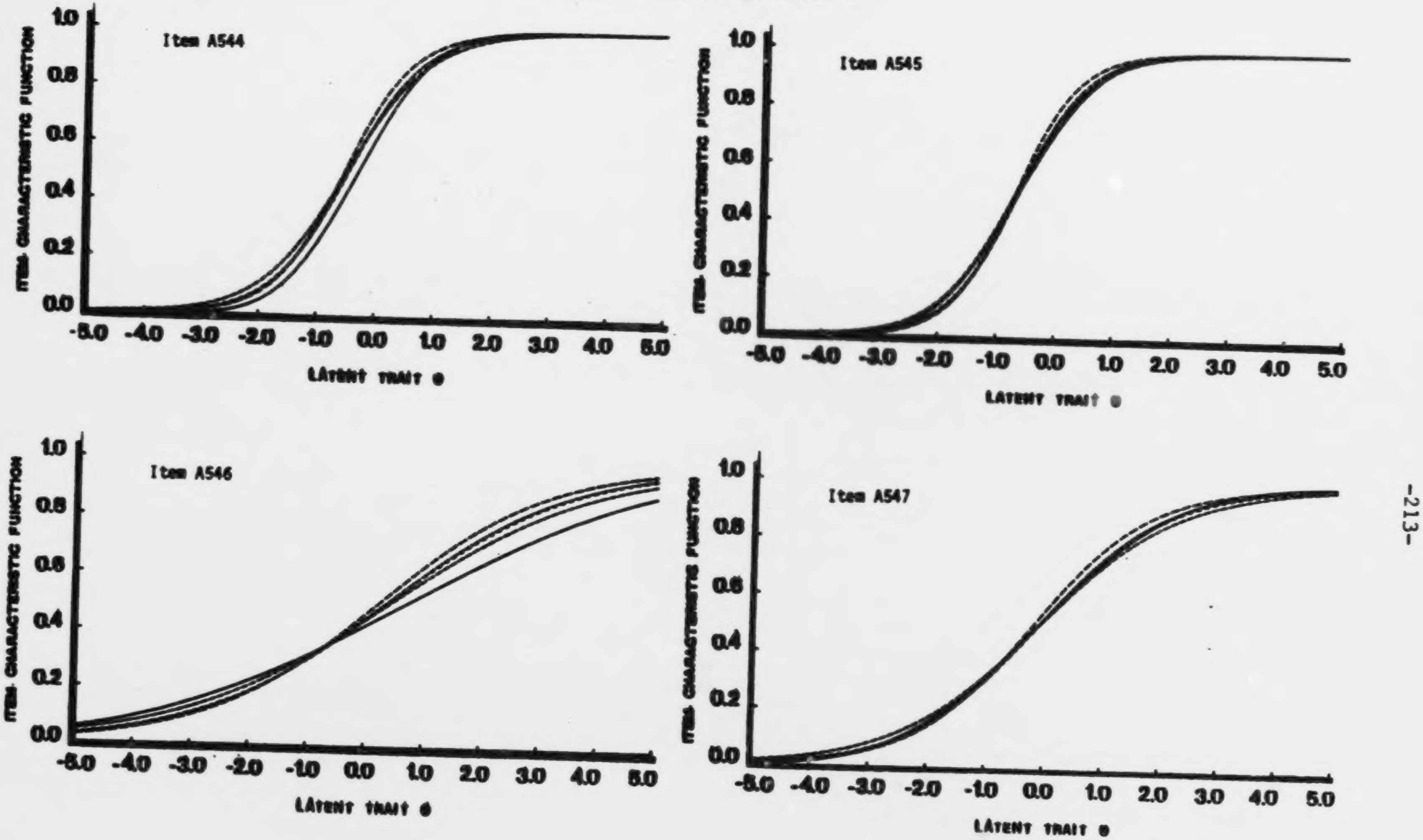

FIGURE 9-1 (Continued)

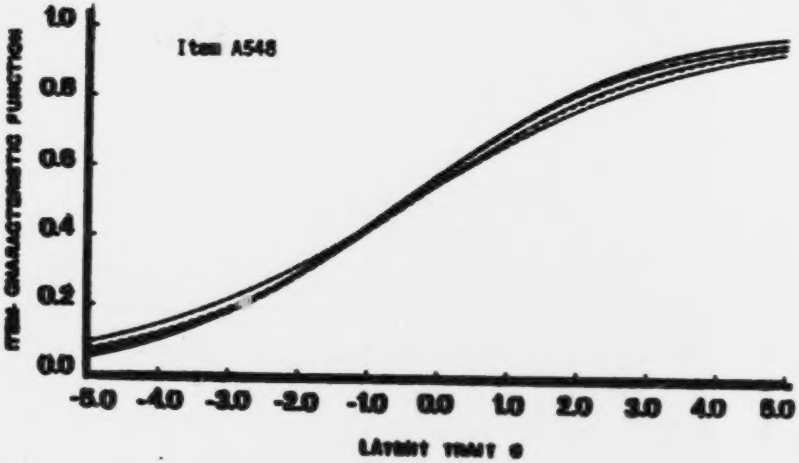

FIGURE 9-1 (Continued)

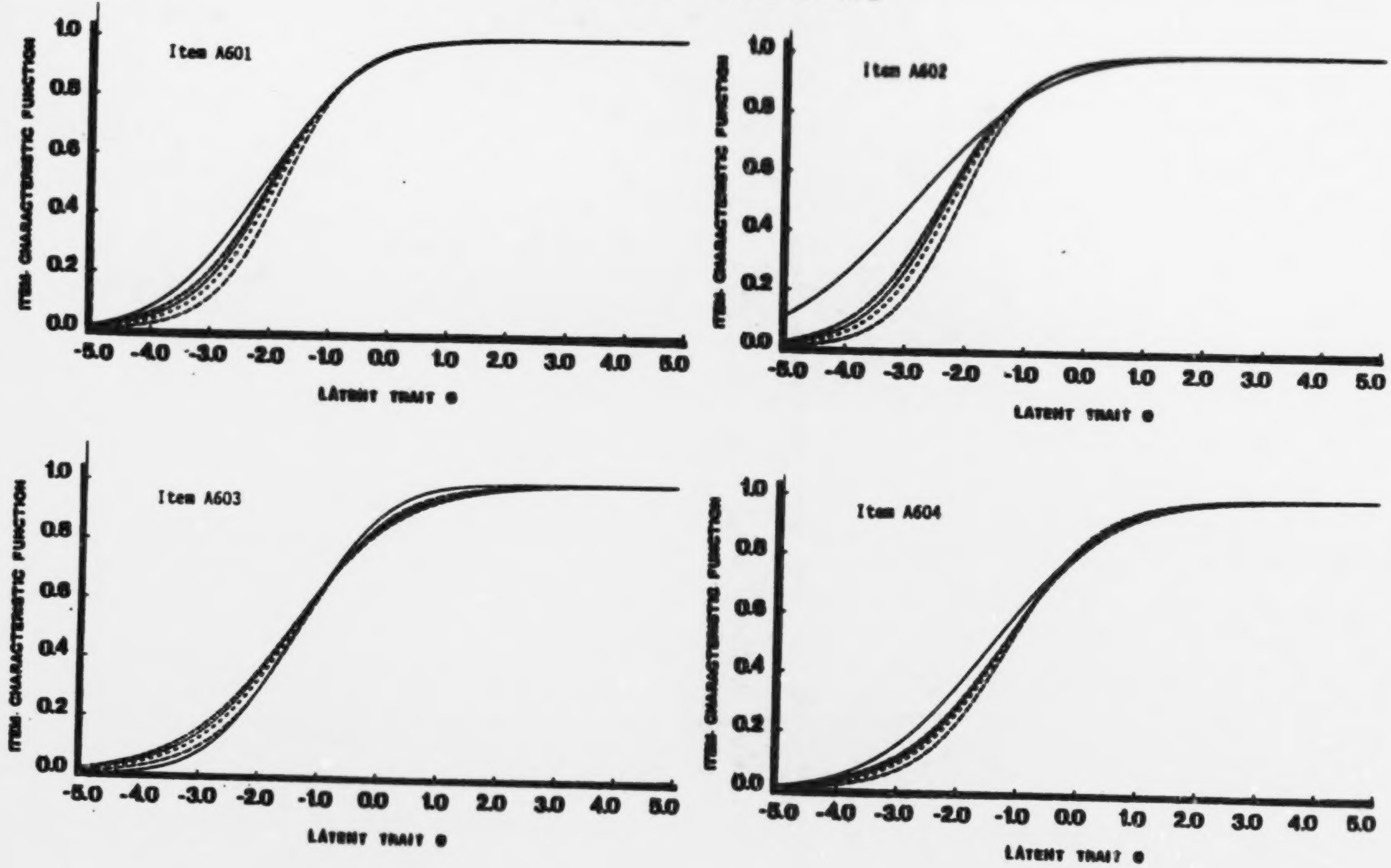

FIGURE 9-2

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the A5-A6 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test A6.

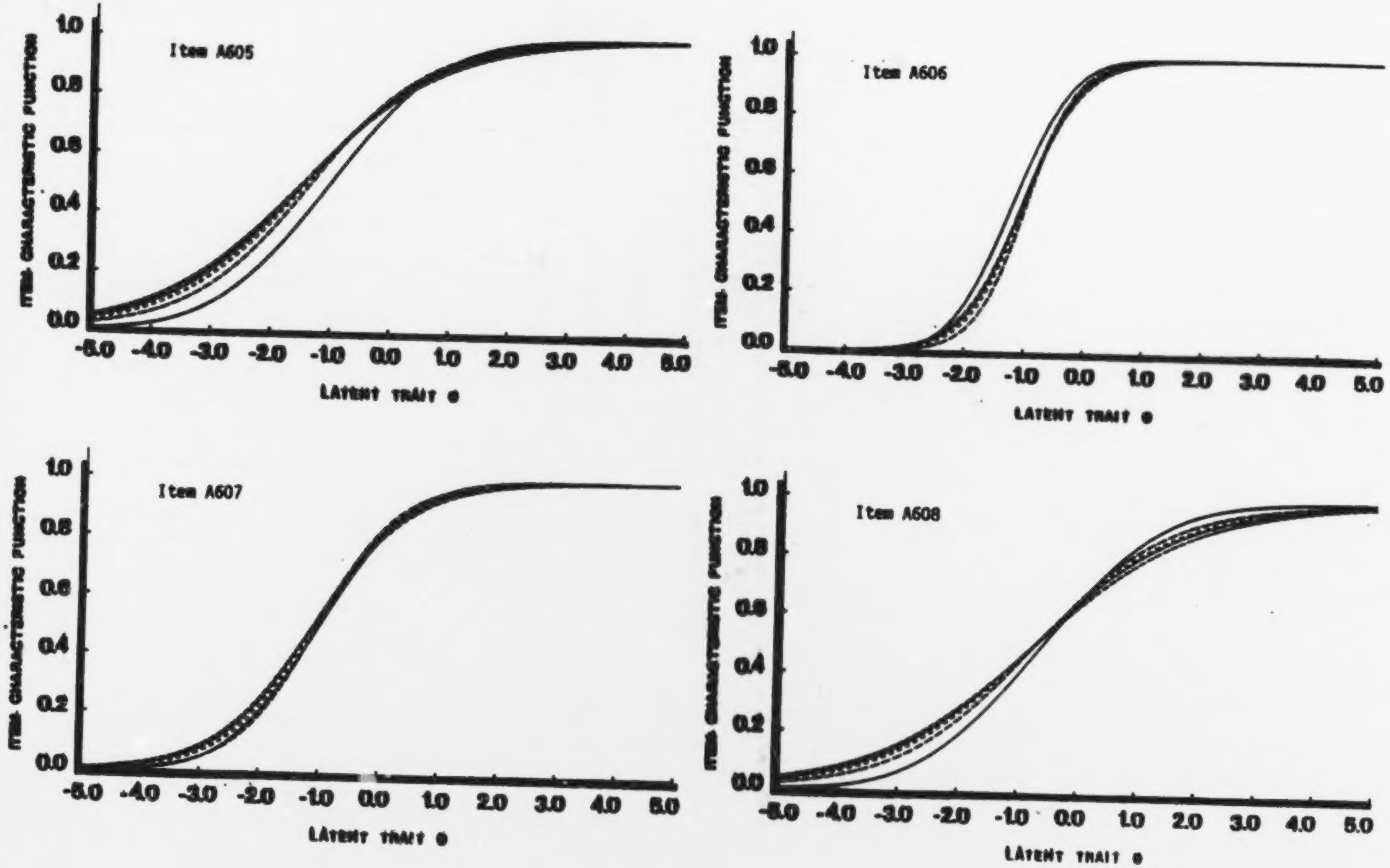

FIGURE 9-2 (Continued)

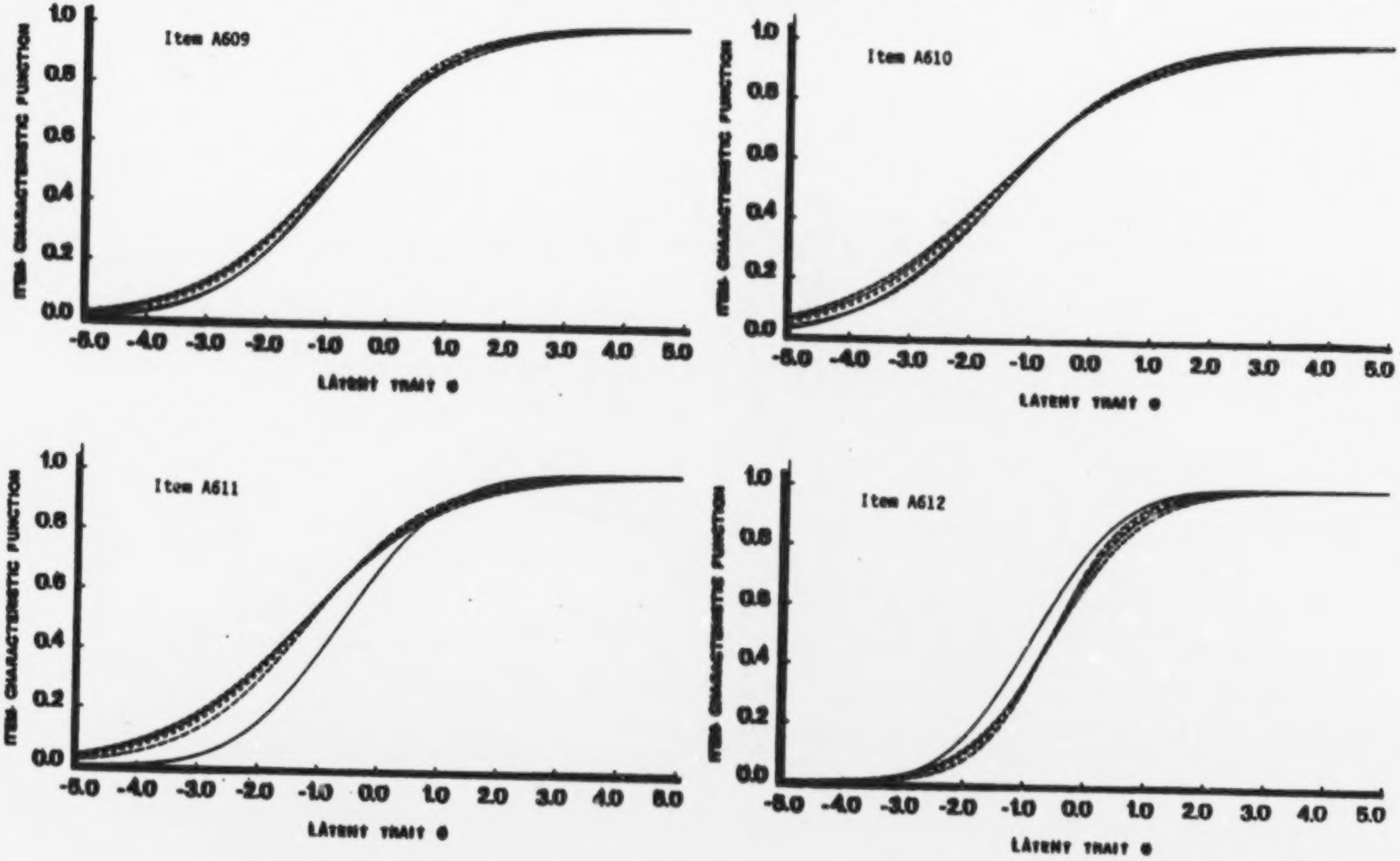

FIGURE 9-2 (Continued)

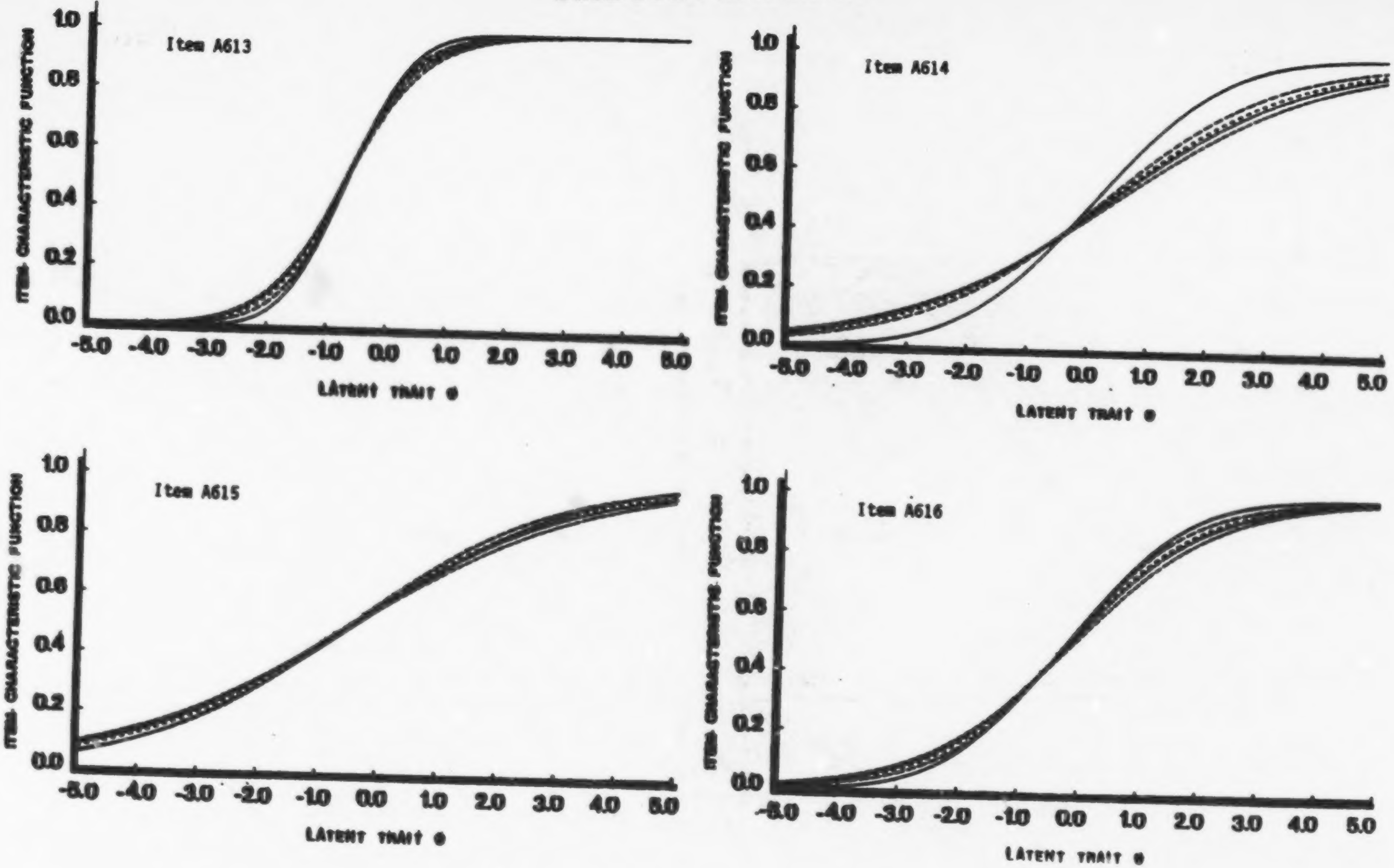

FIGURE 9-2 (Continued)

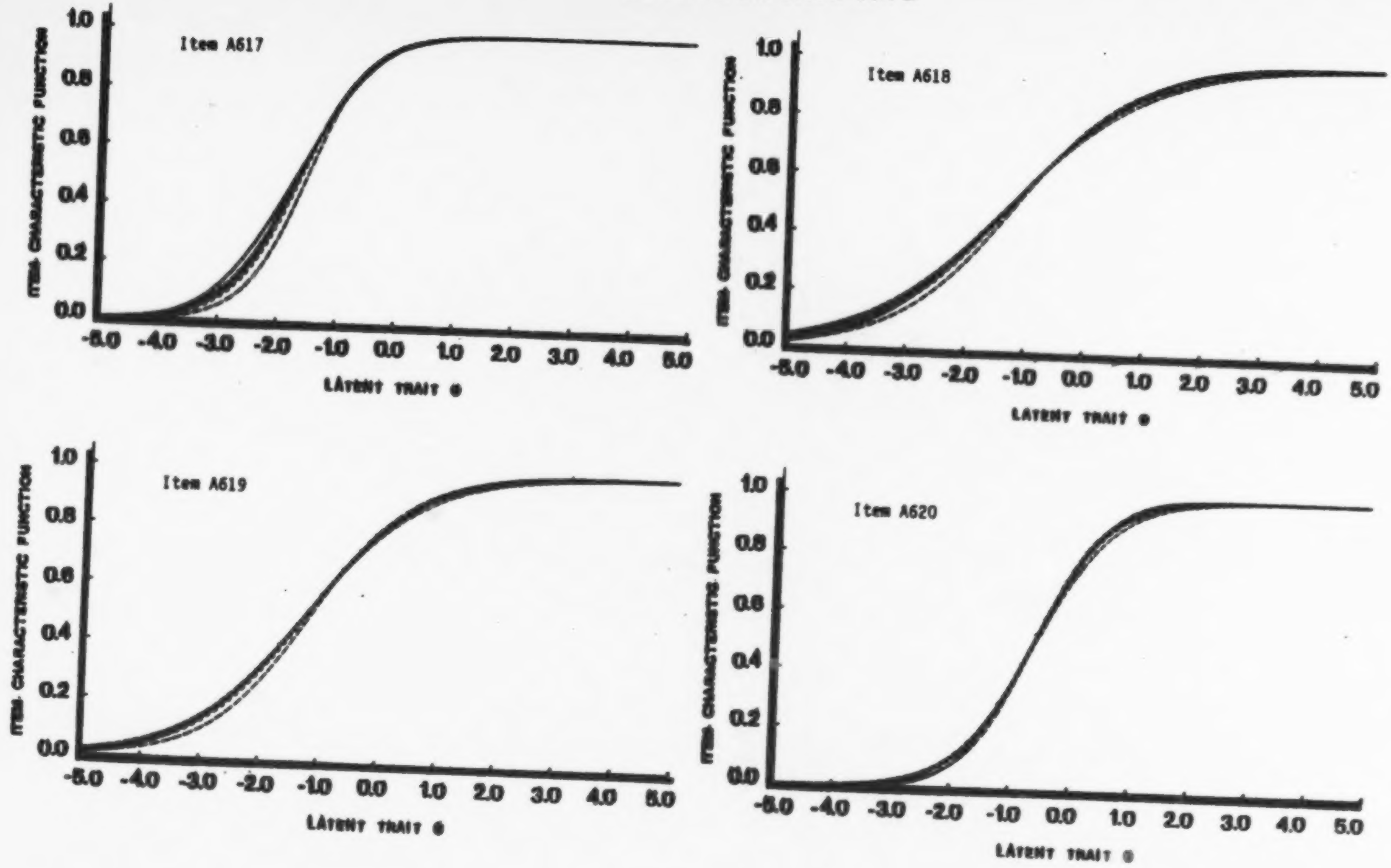

FIGURE 9-2 (Continued)

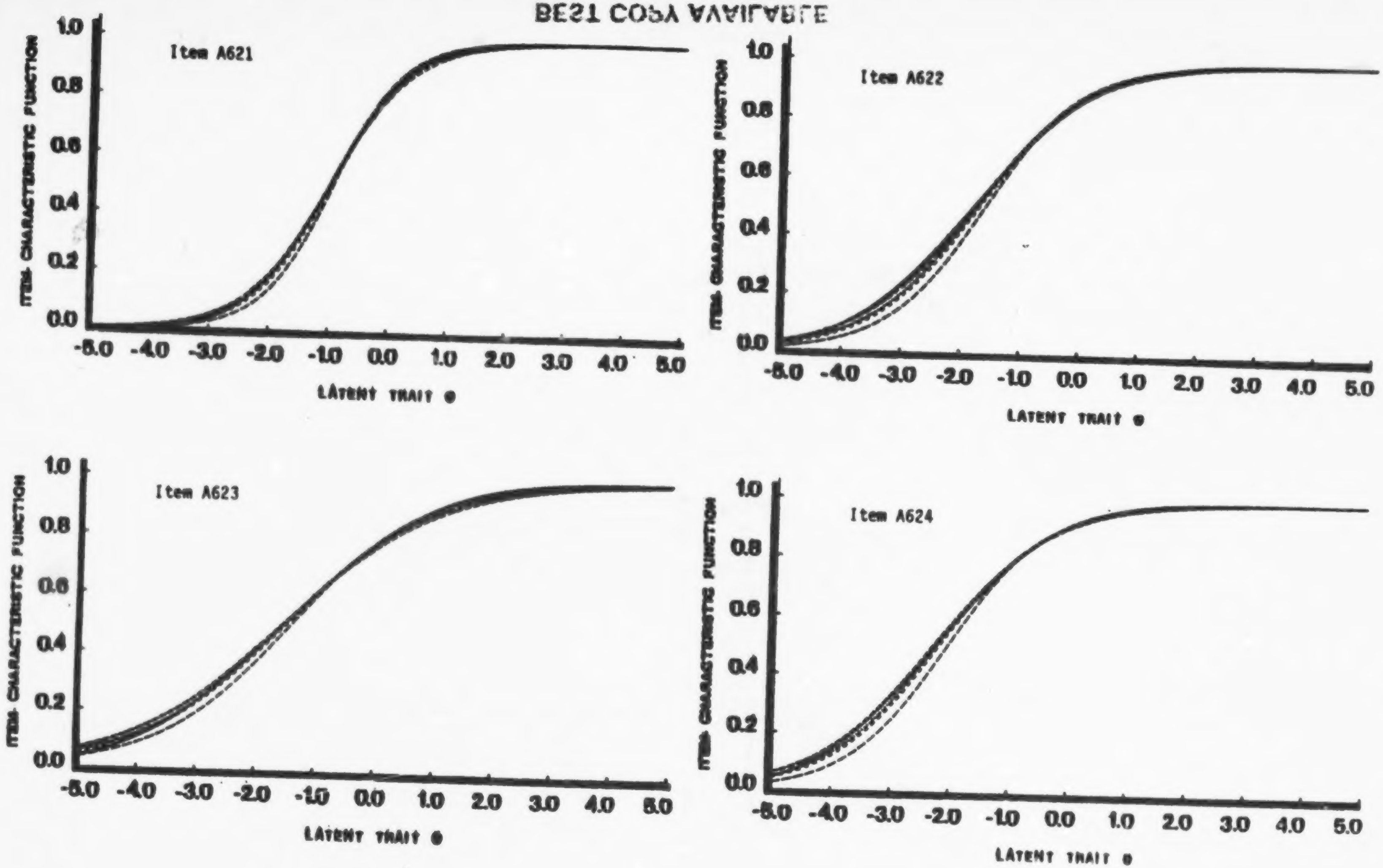

FIGURE 9-2 (Continued)

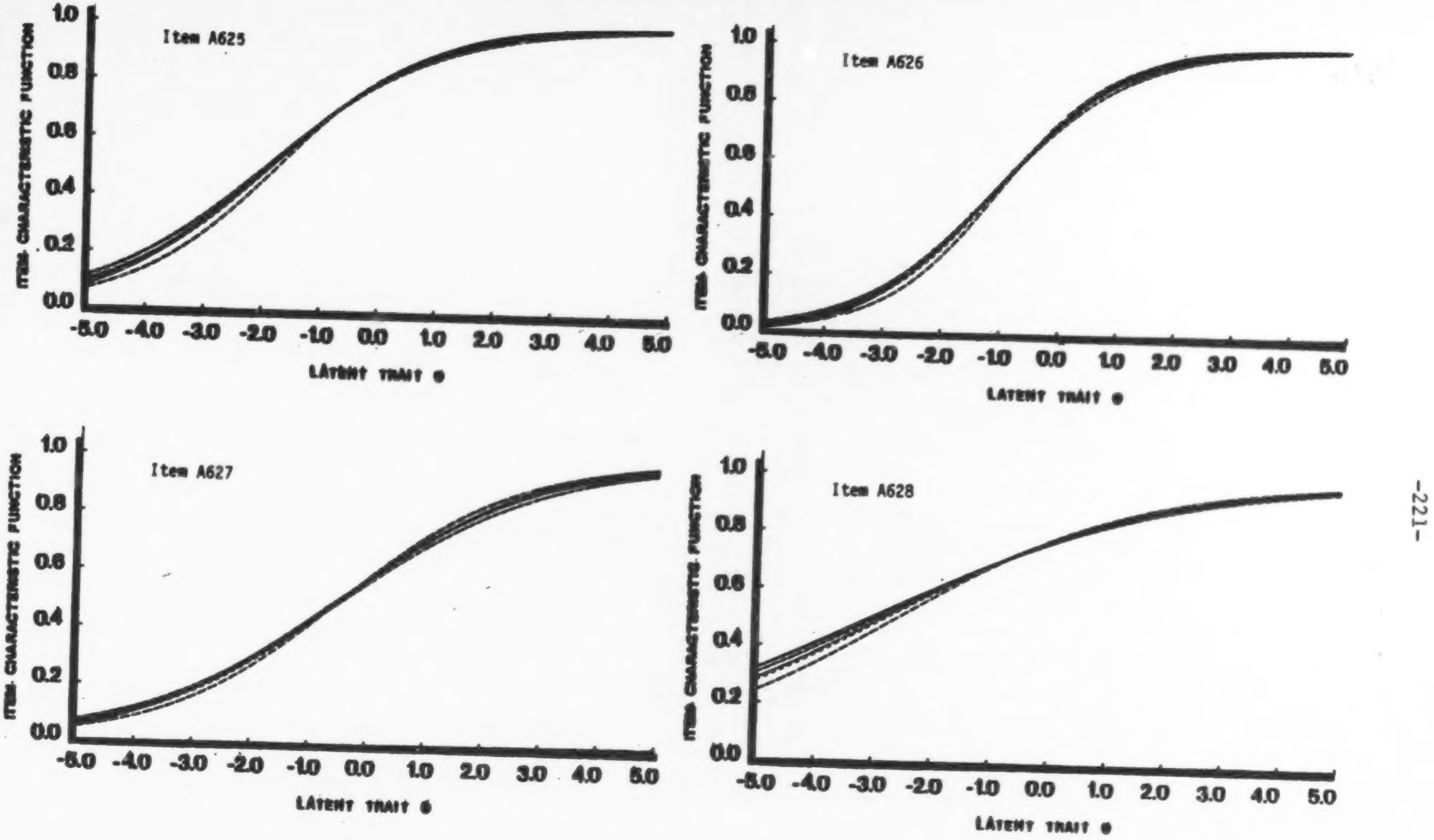

FIGURE 9-2 (Continued)

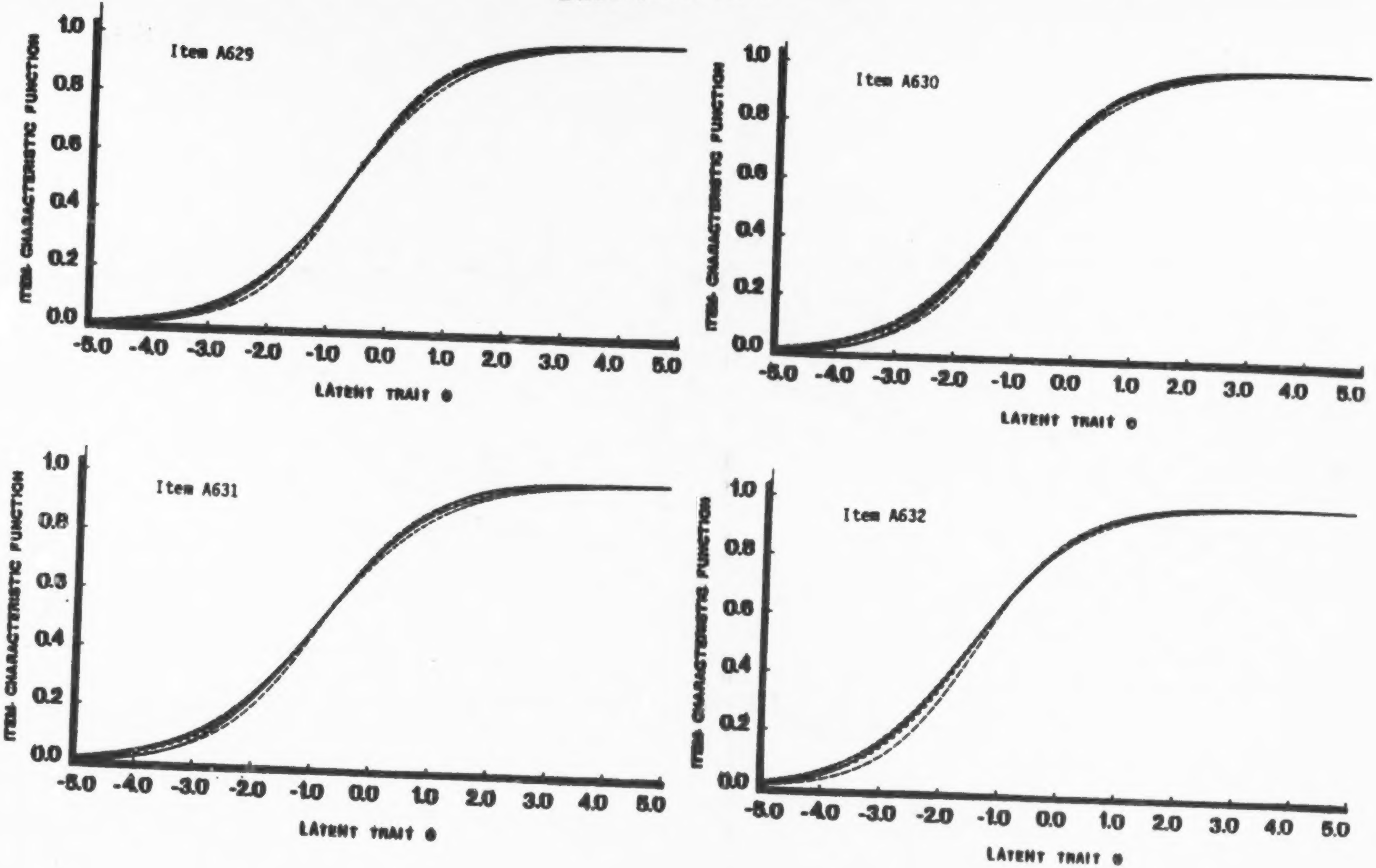

FIGURE 9-2 (Continued)

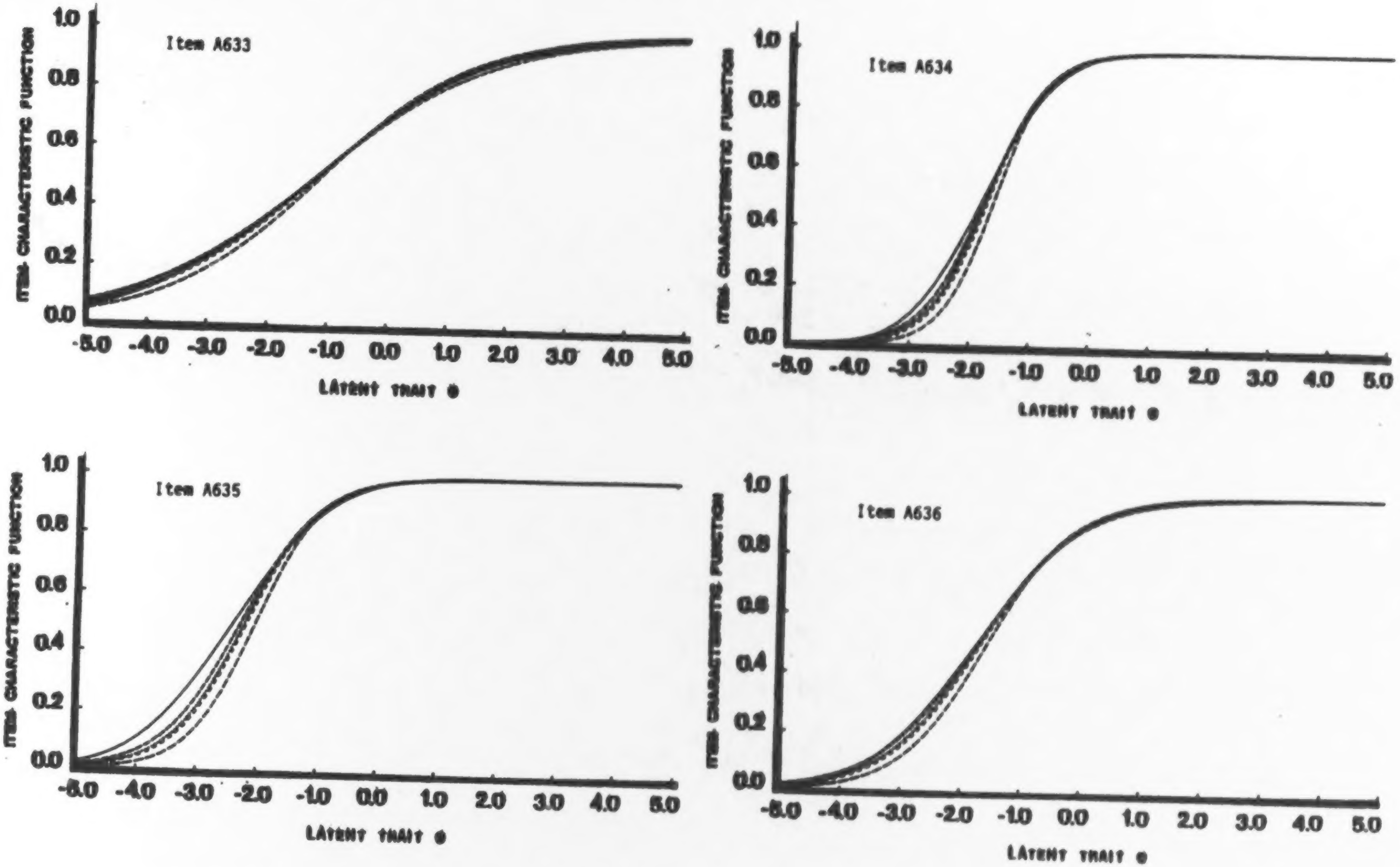

FIGURE 9-2 (Continued)

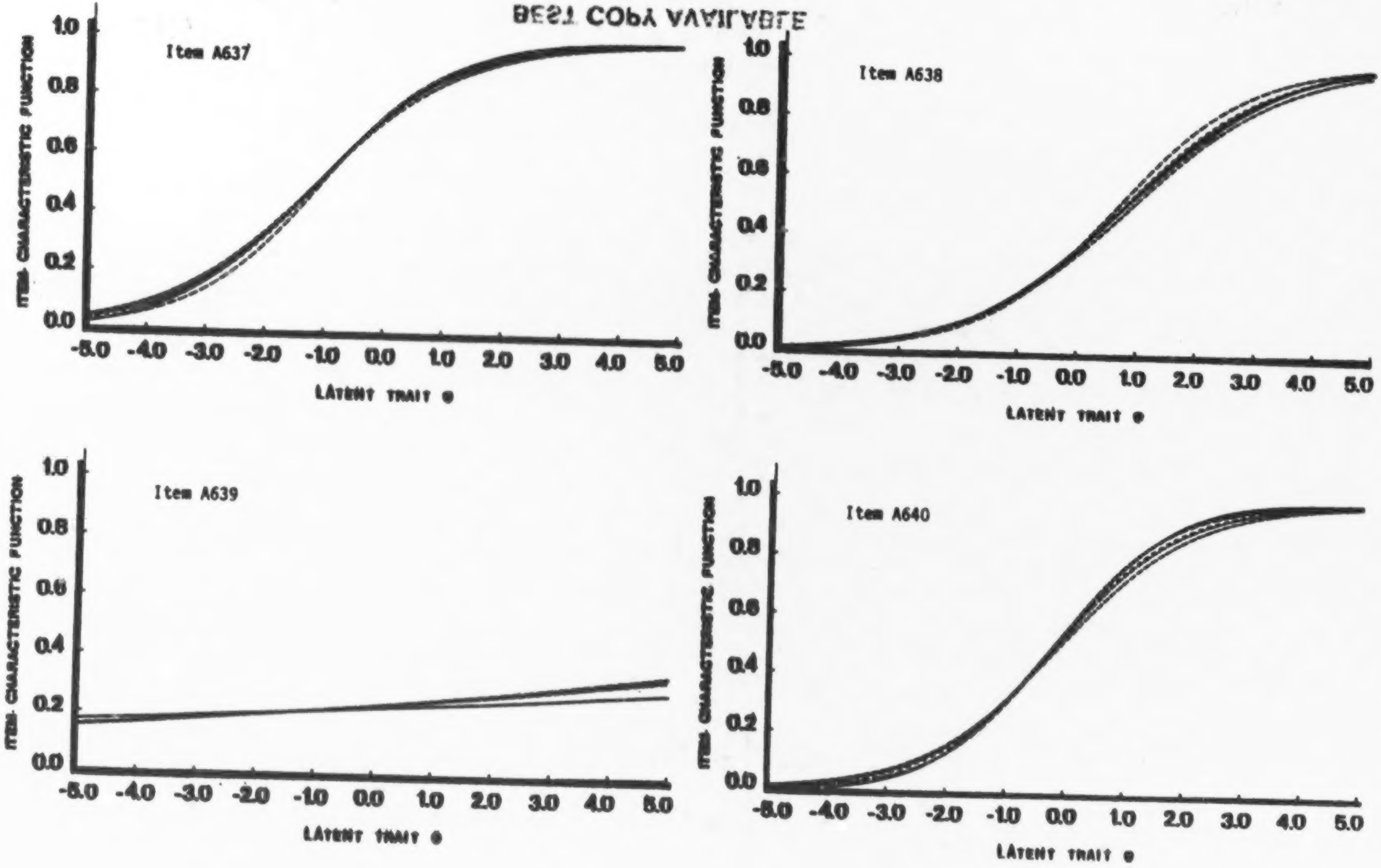

FIGURE 9-2 (Continued)

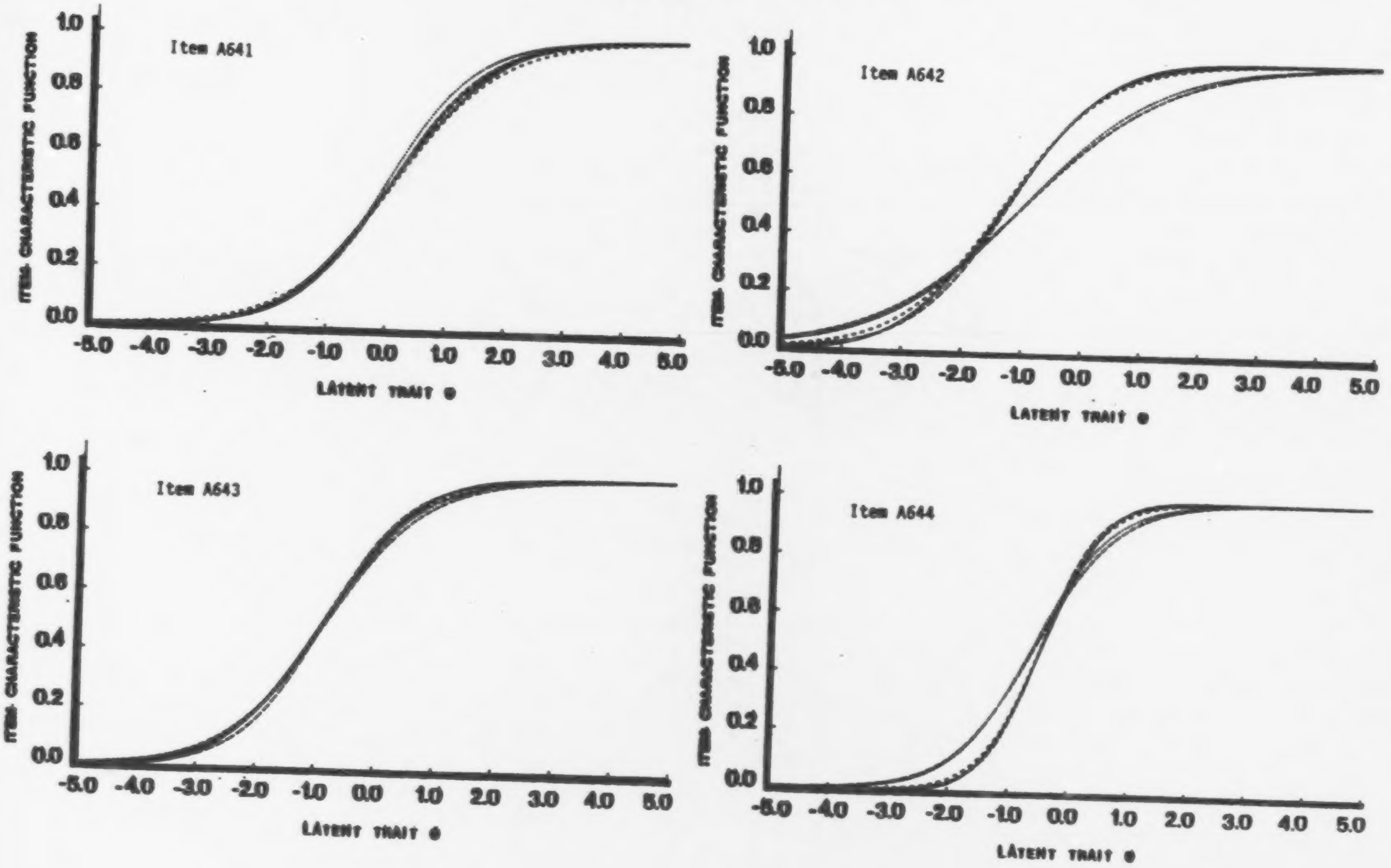

FIGURE 9-2 (Continued)

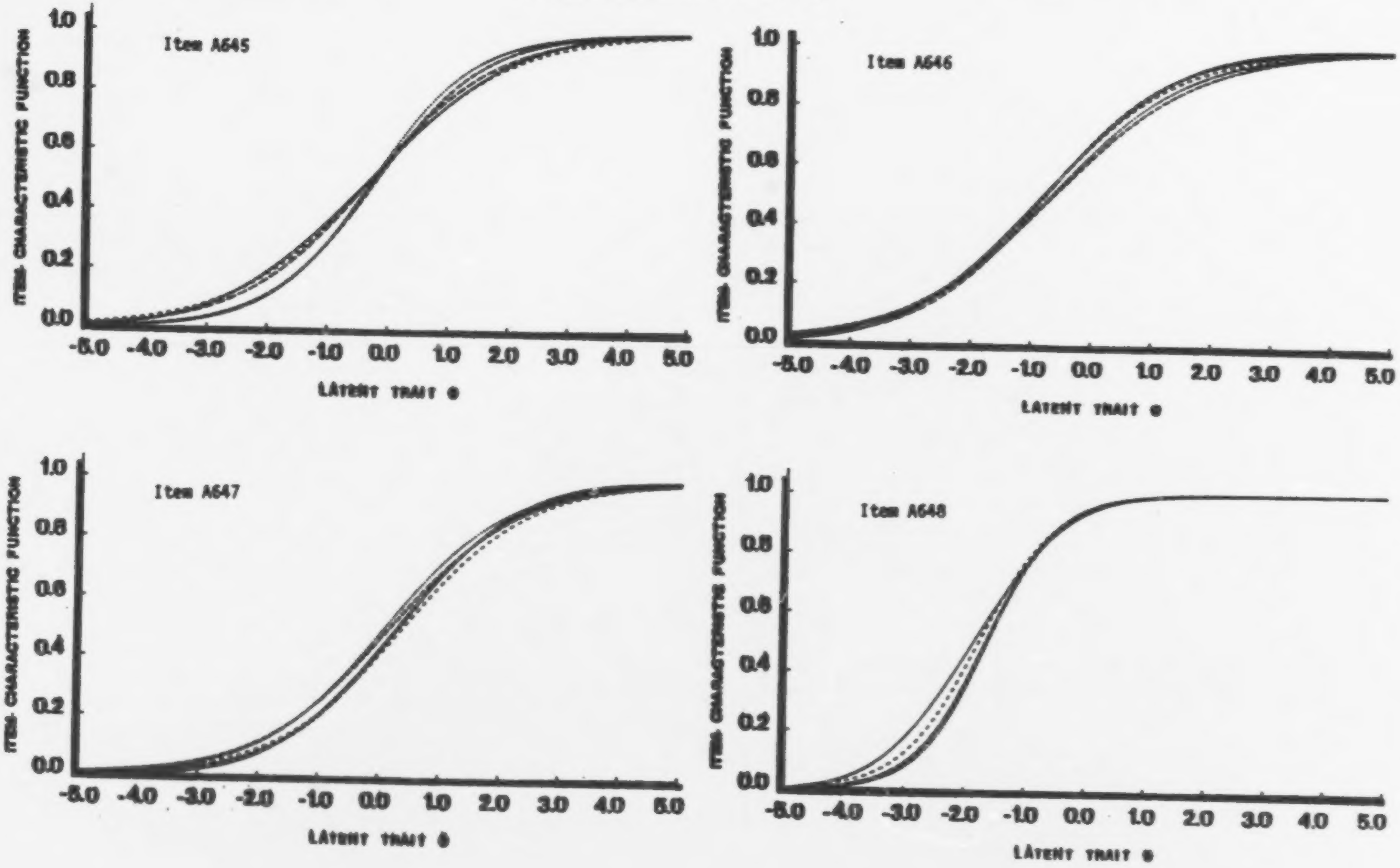

FIGURE 9-2 (Continued)

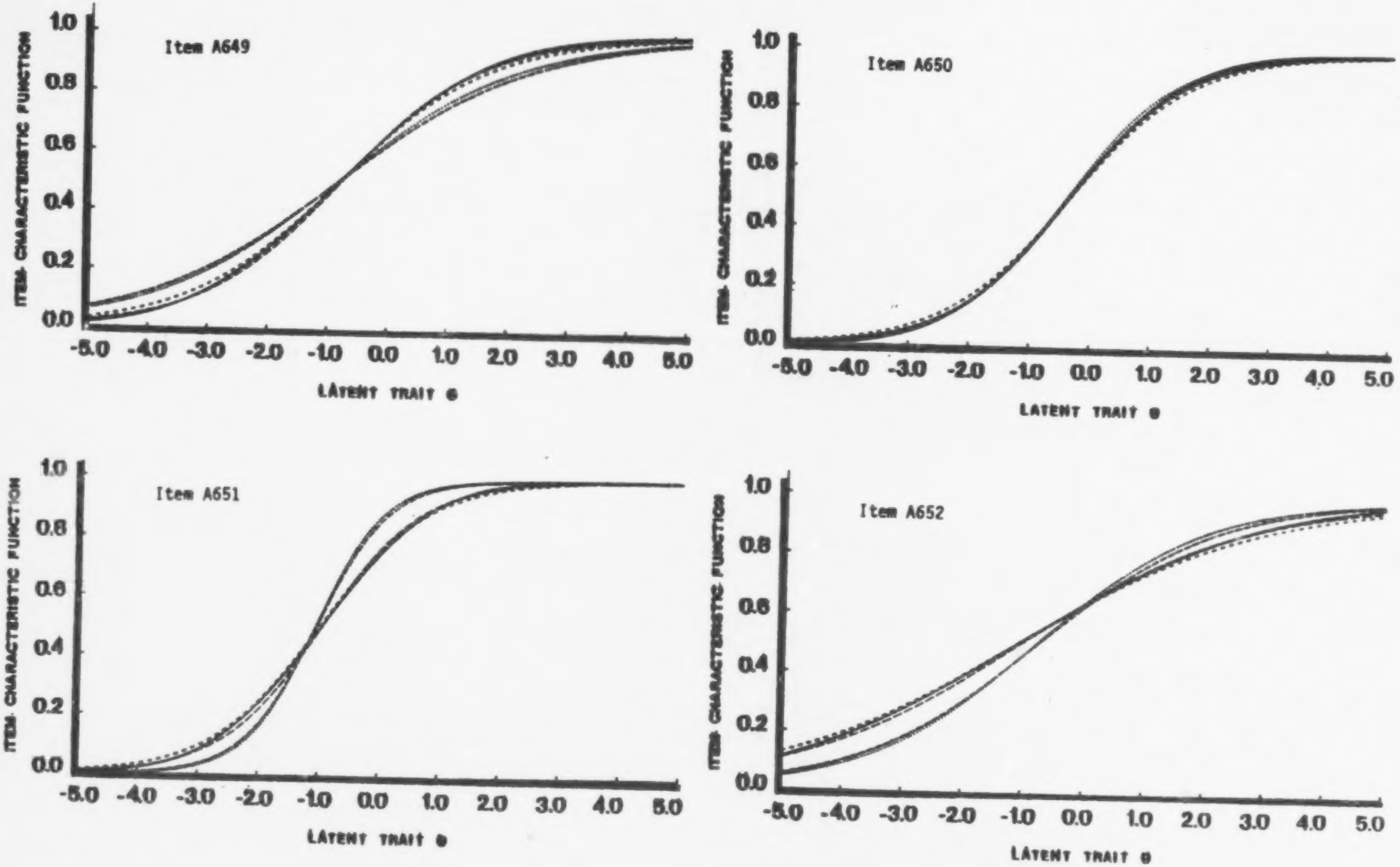

FIGURE 9-2 (Continued)

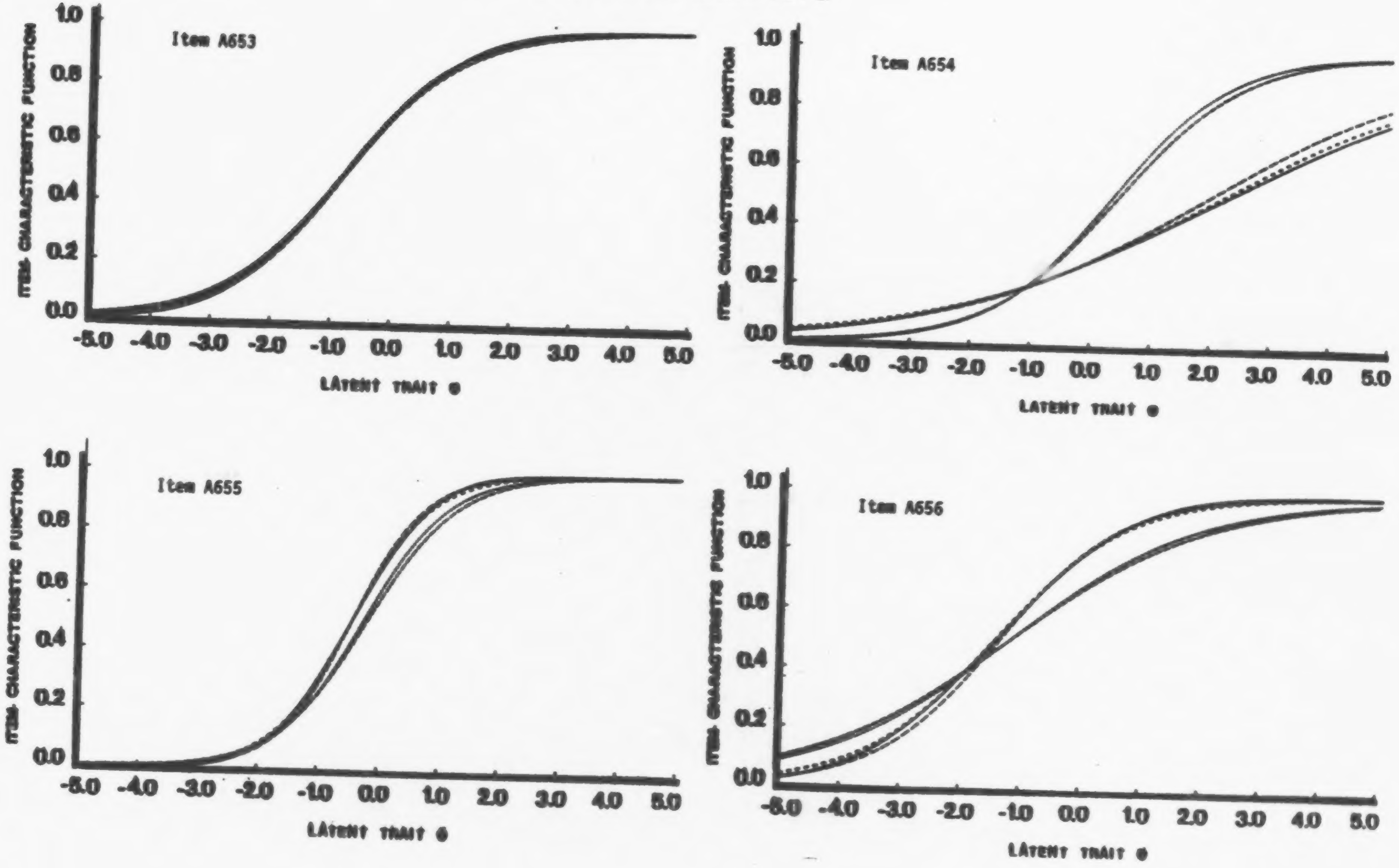

FIGURE 9-2 (Continued)

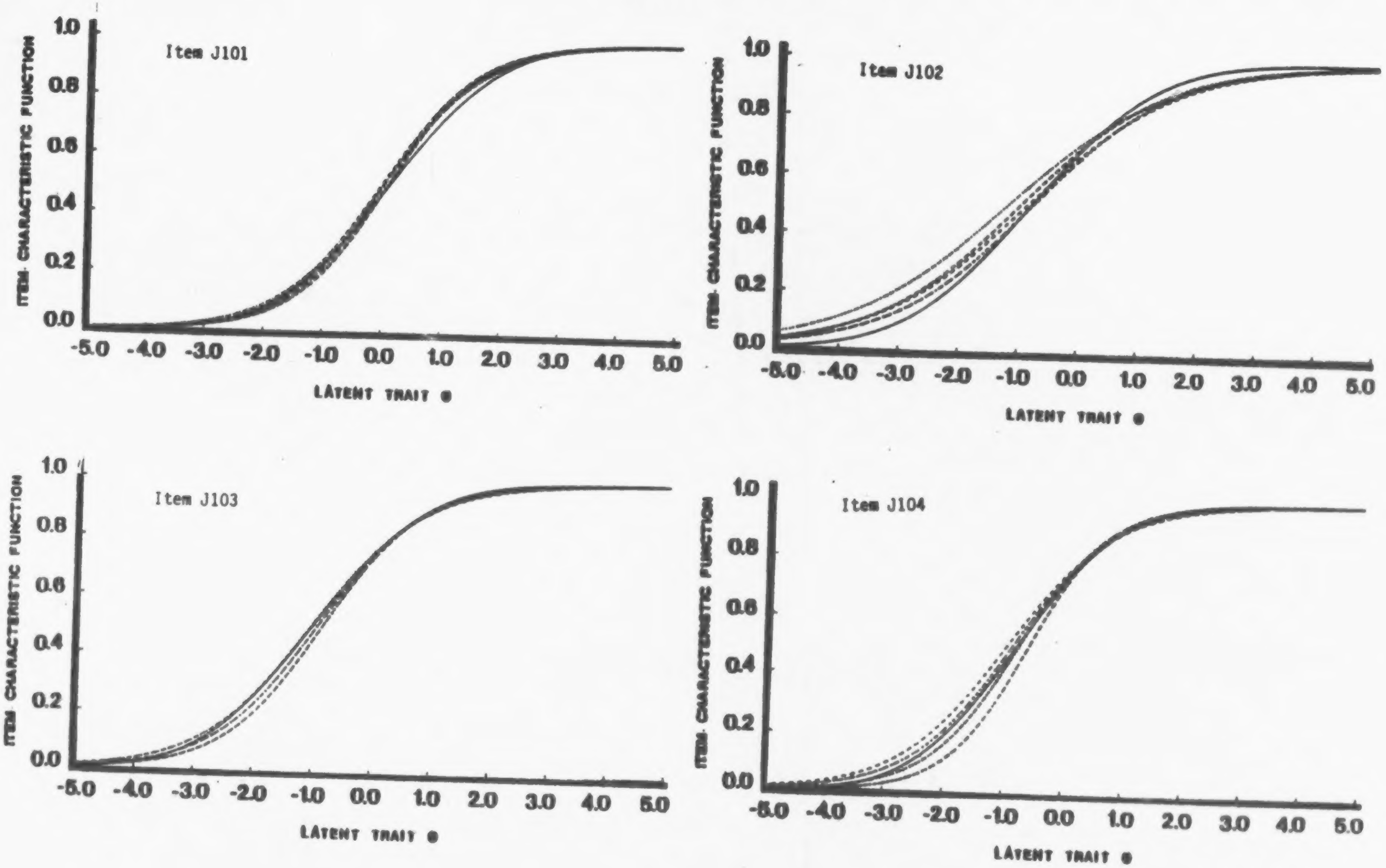

FIGURE 9-3

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the J1-J2 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1.

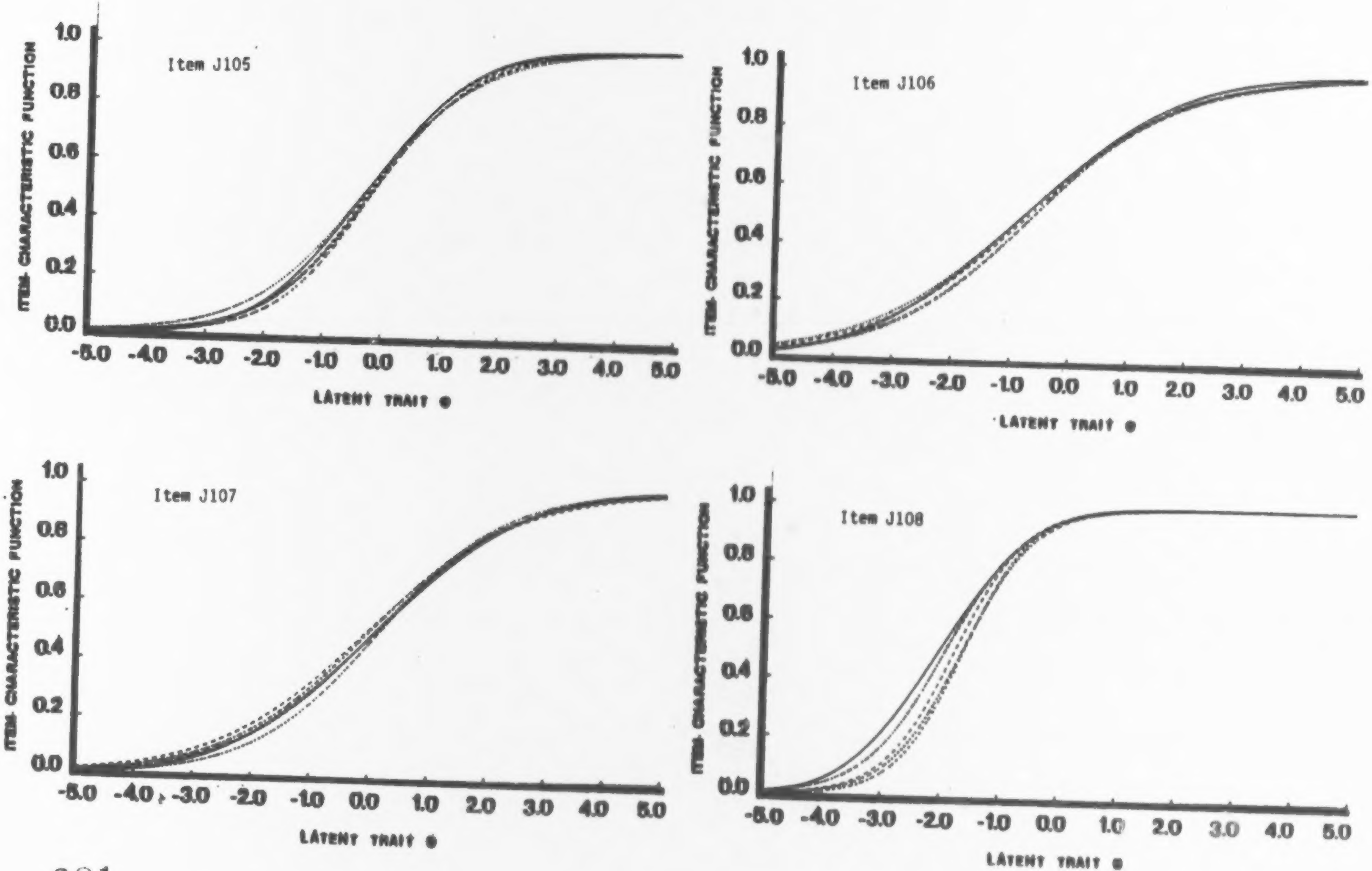

FIGURE 9-3 (Continued)

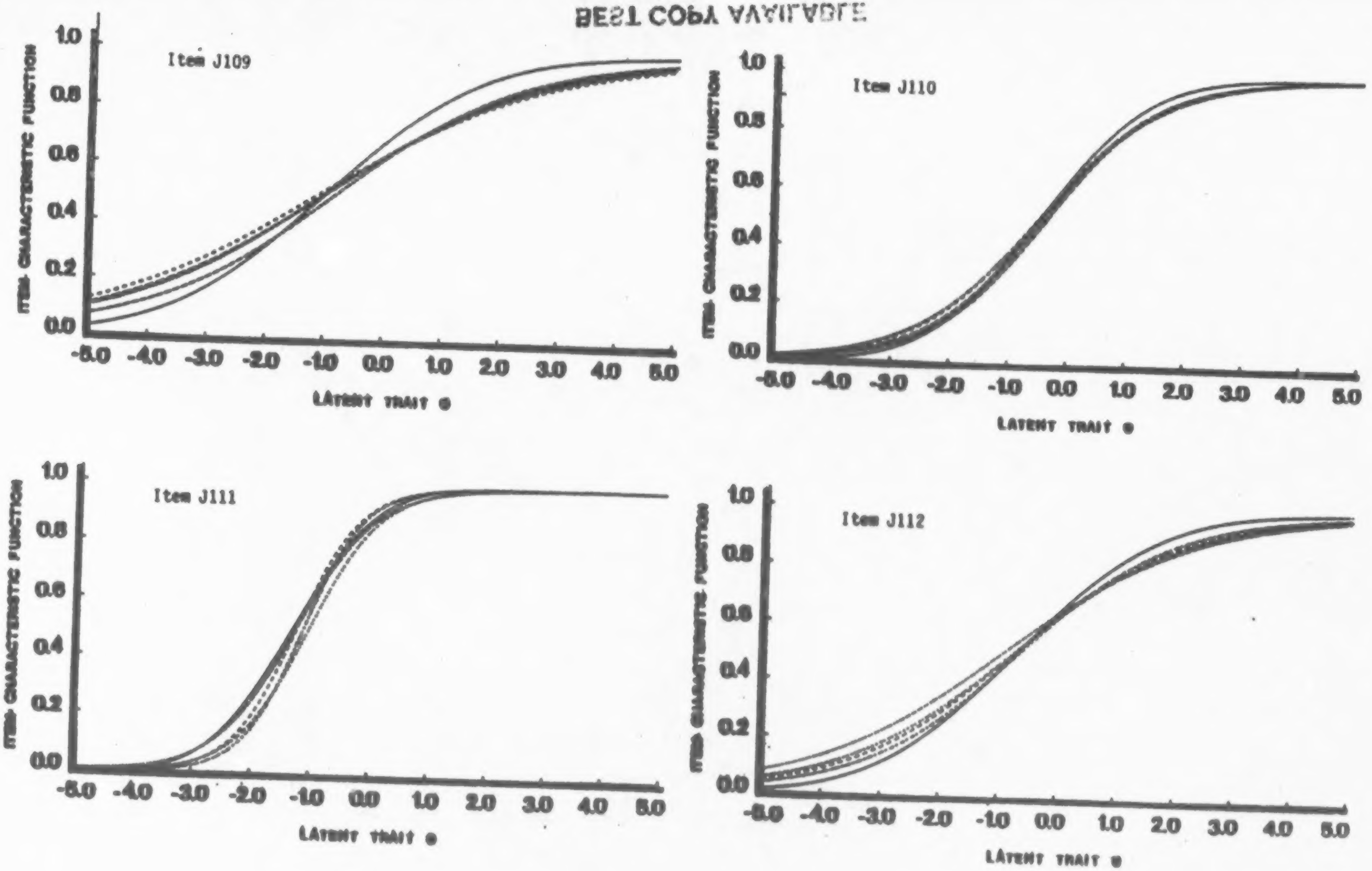

FIGURE 9-3 (Continued)

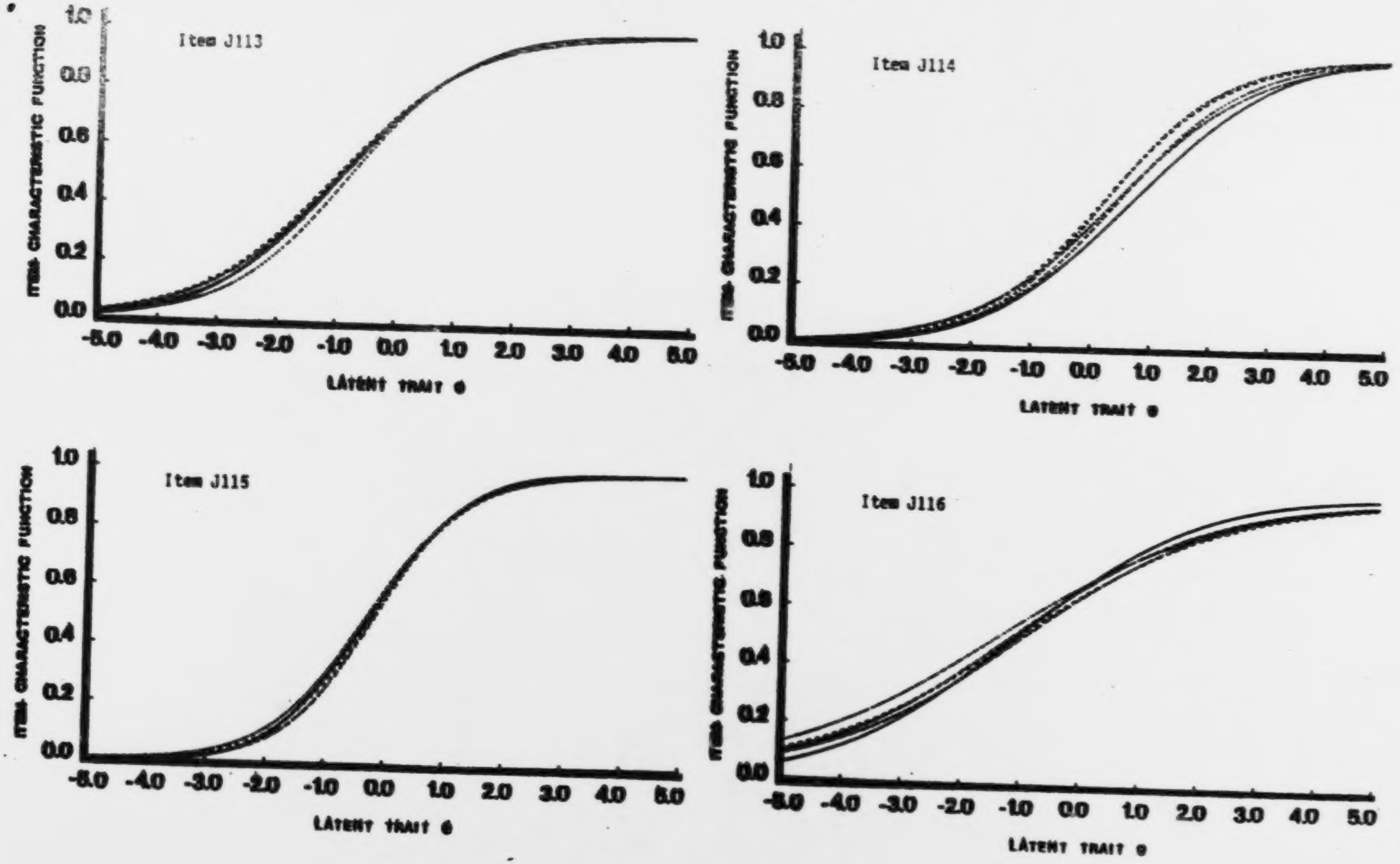

FIGURE 9-3 (Continued)

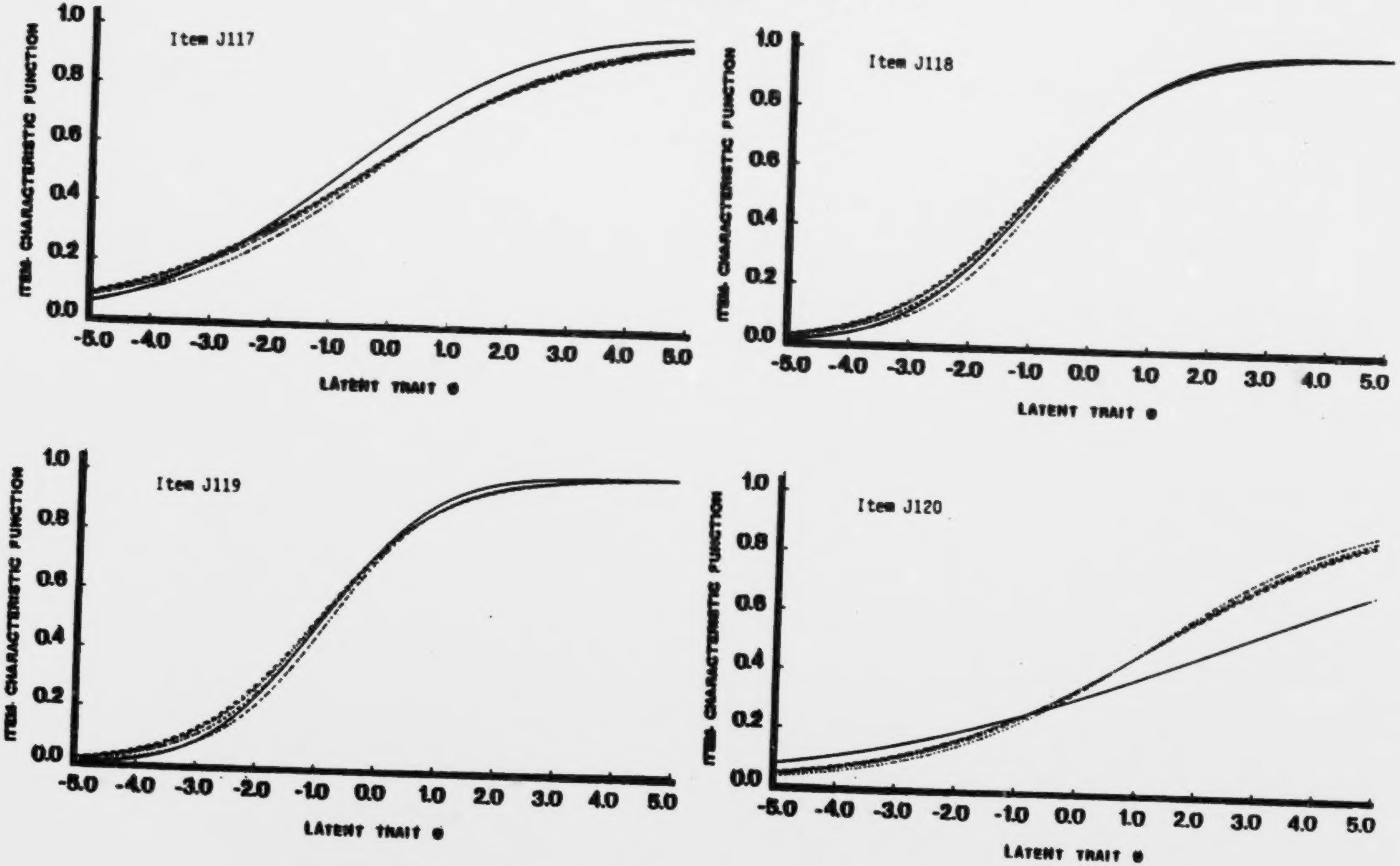

FIGURE 9-3 (Continued)

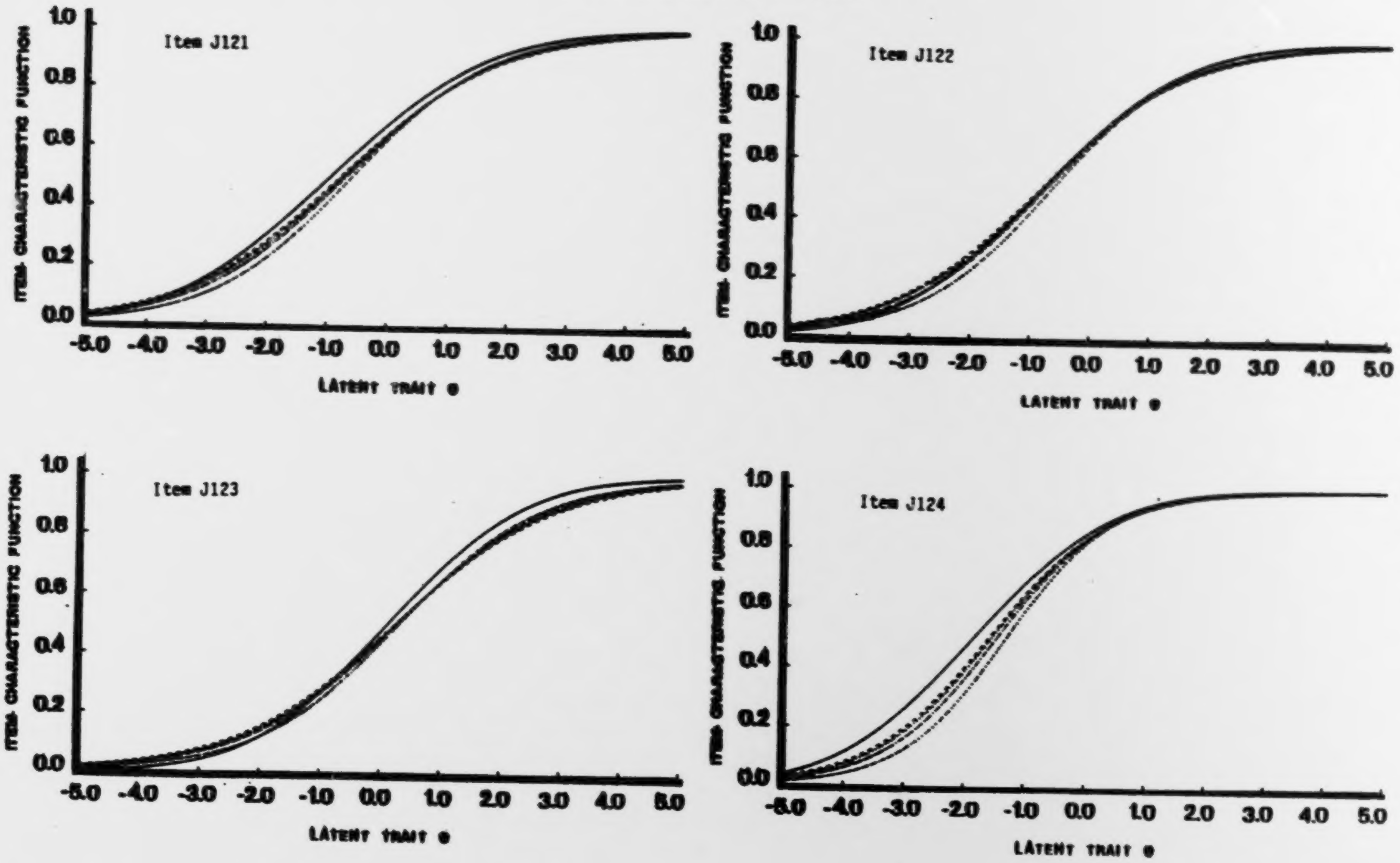

FIGURE 9-3 (Continued)

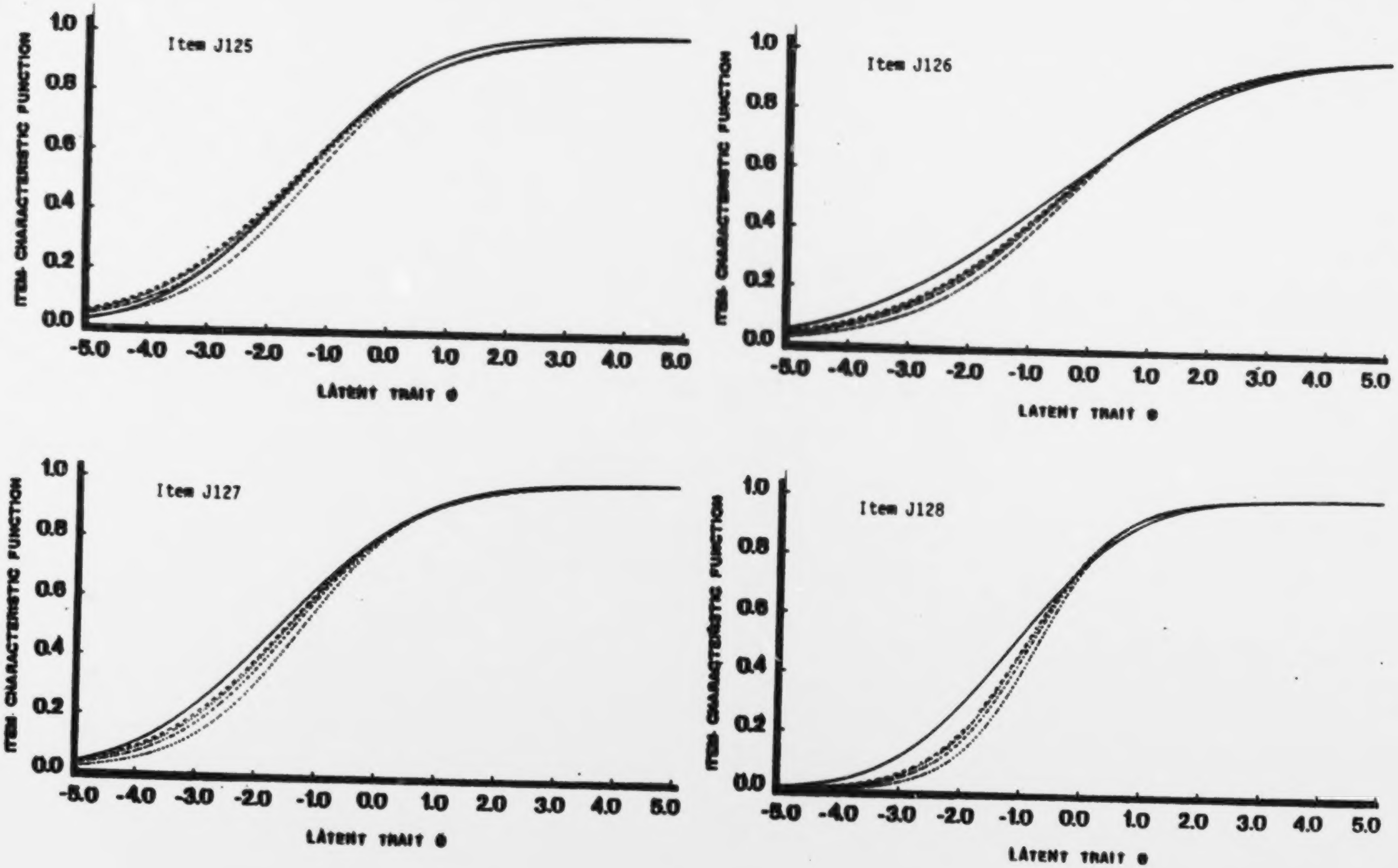

FIGURE 9-3 (Continued)

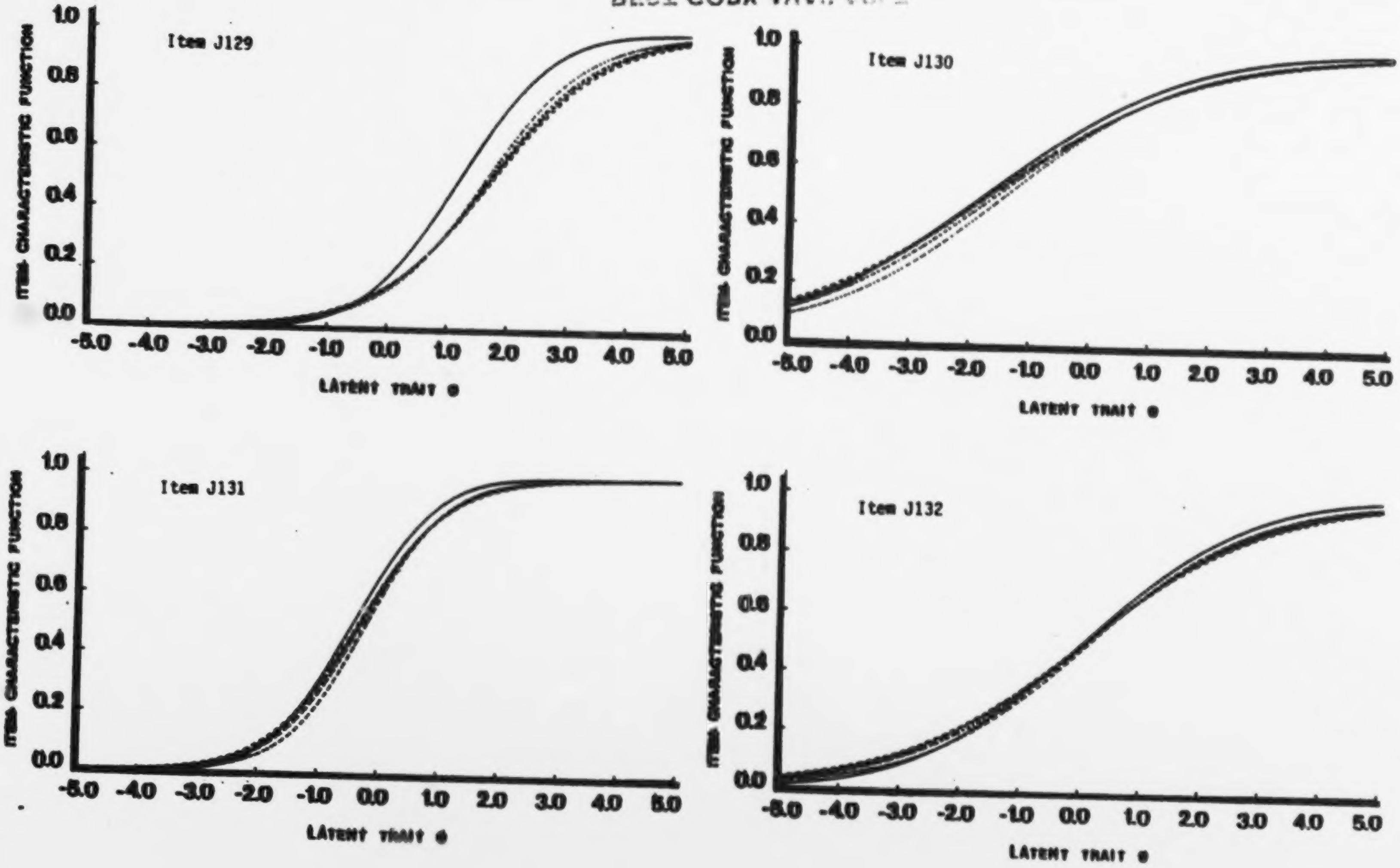

FIGURE 9-3 (Continued)

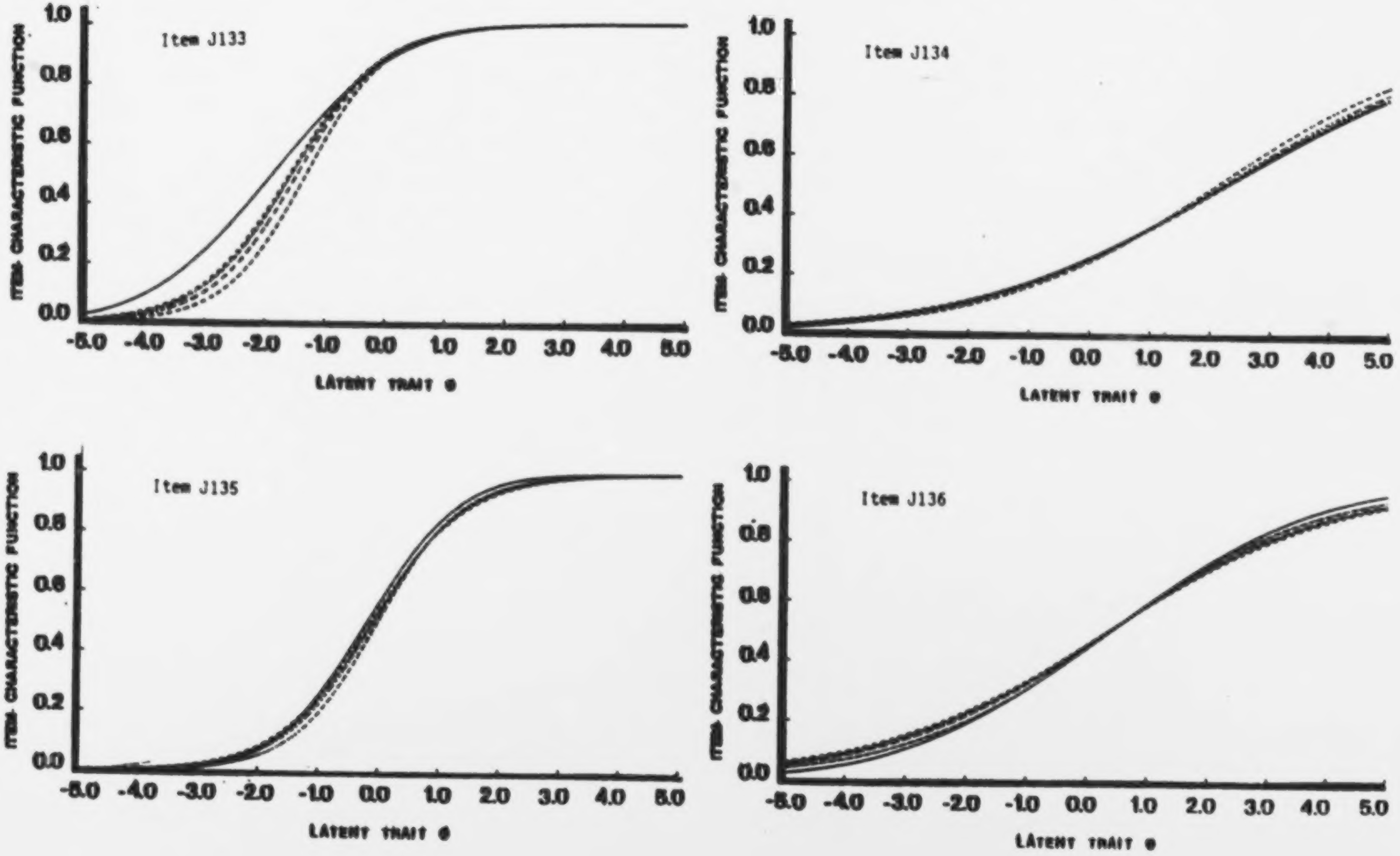

FIGURE 9-3 (Continued)

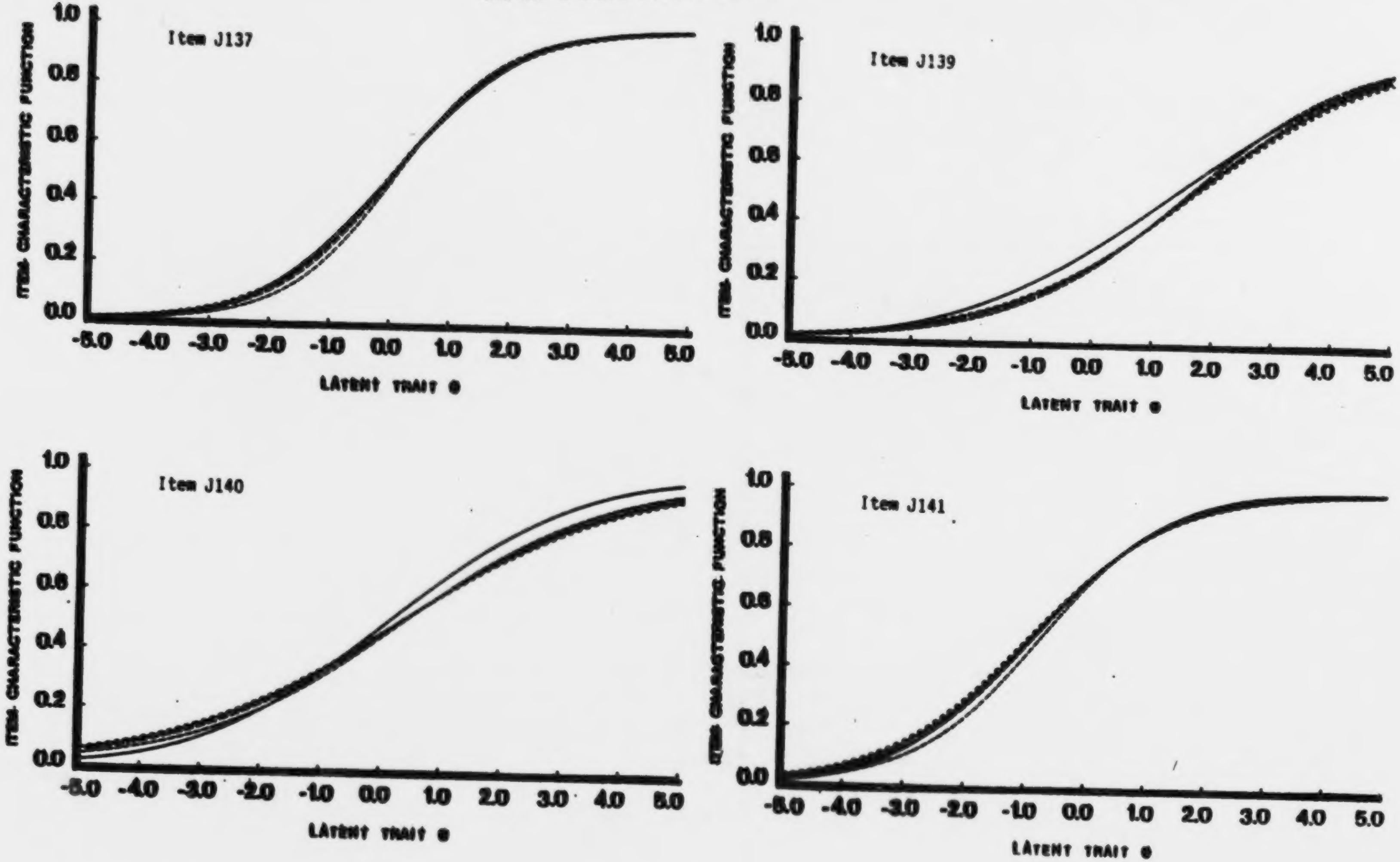

FIGURE 9-3 (Continued)

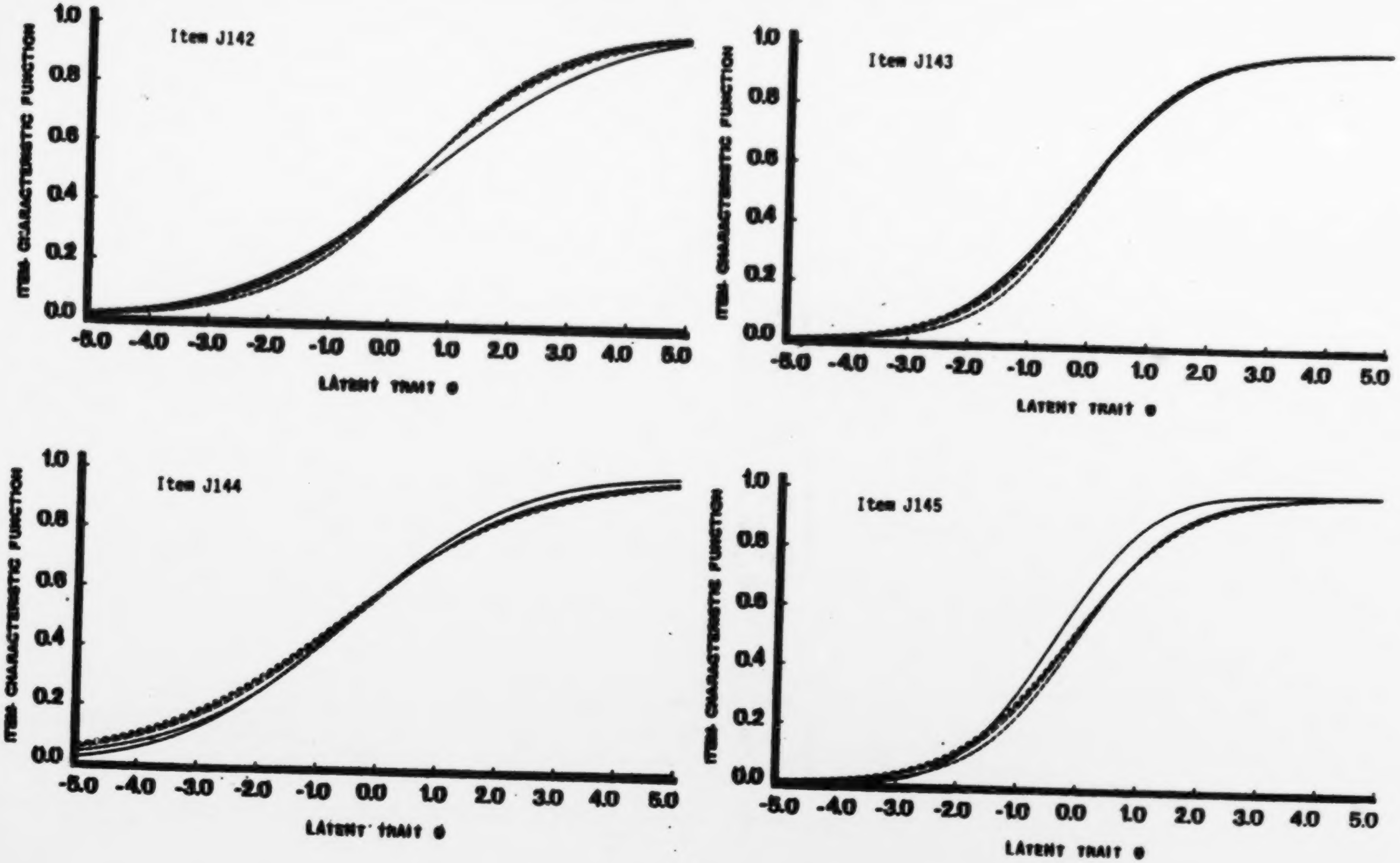

FIGURE 9-3 (Continued)

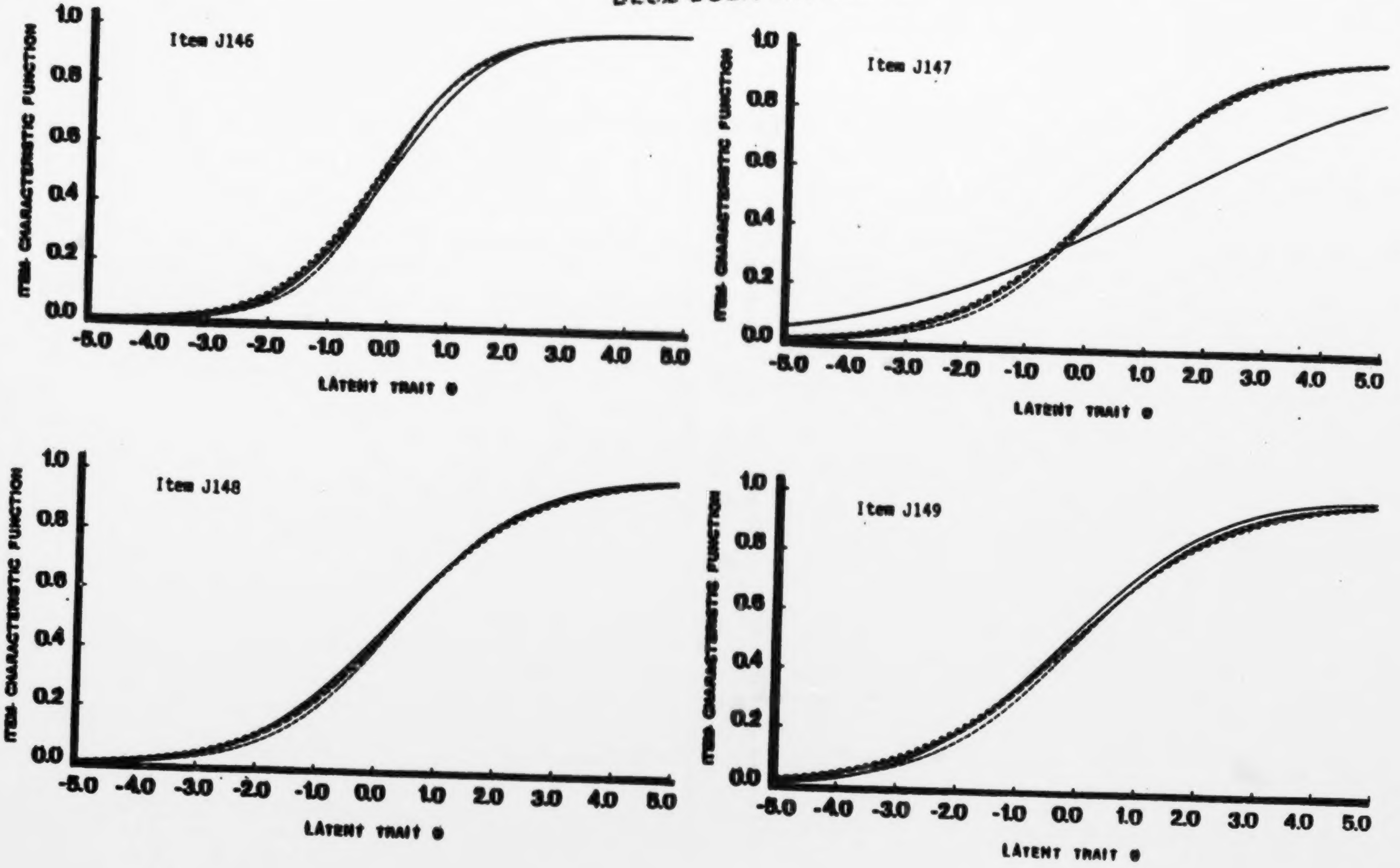

FIGURE 9-3 (Continued)

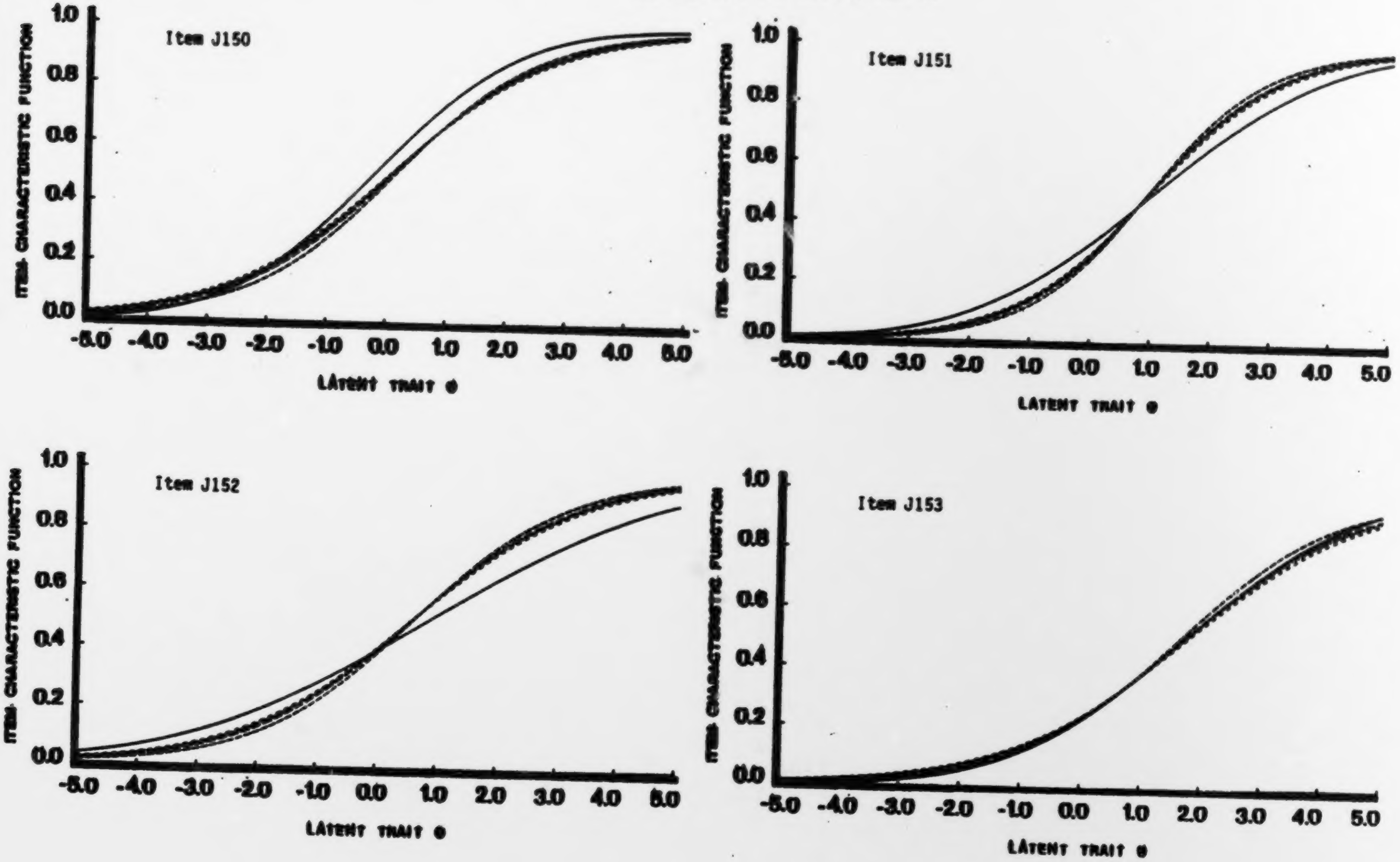

FIGURE 9-3 (Continued)

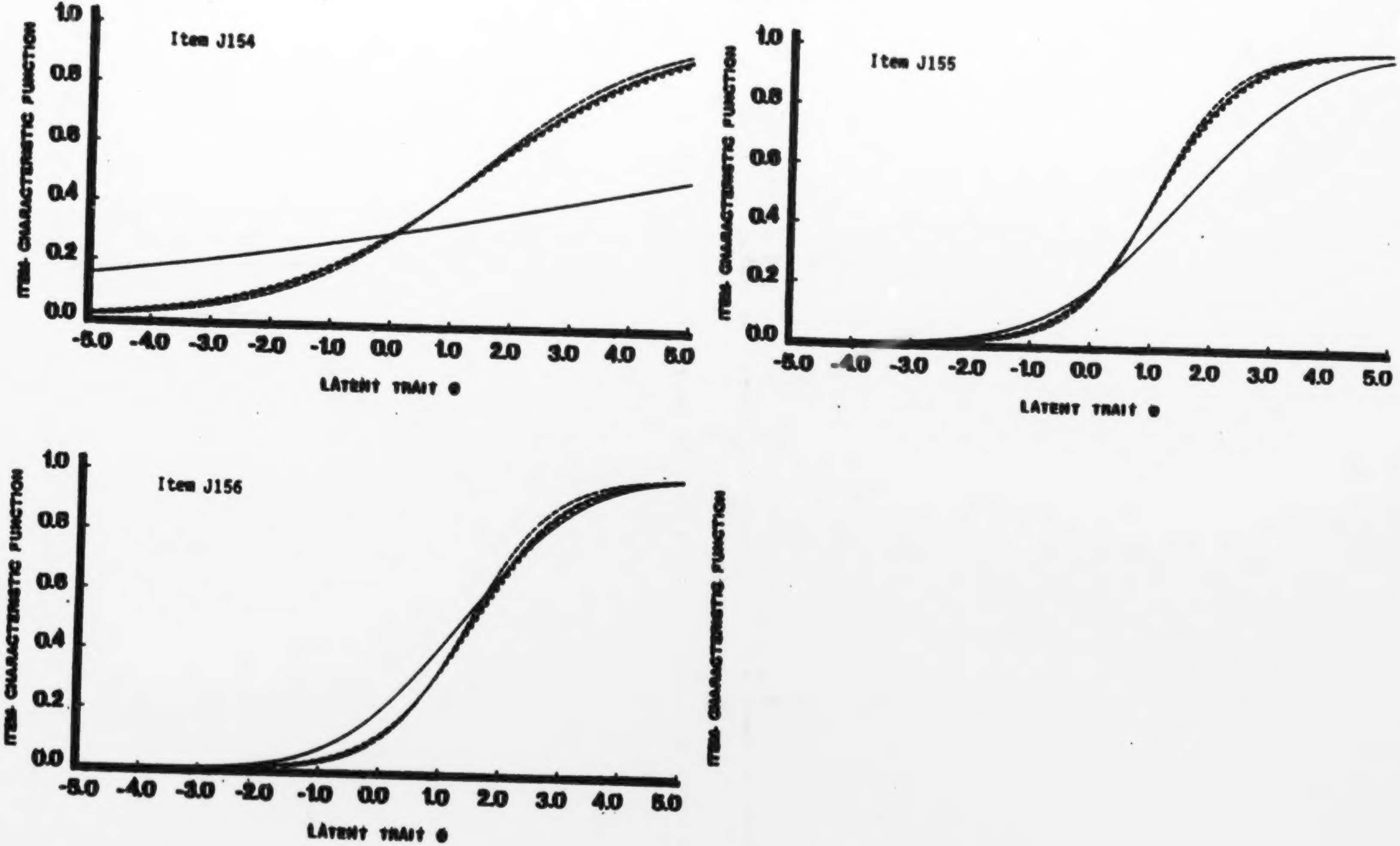

FIGURE 9-3 (Continued)

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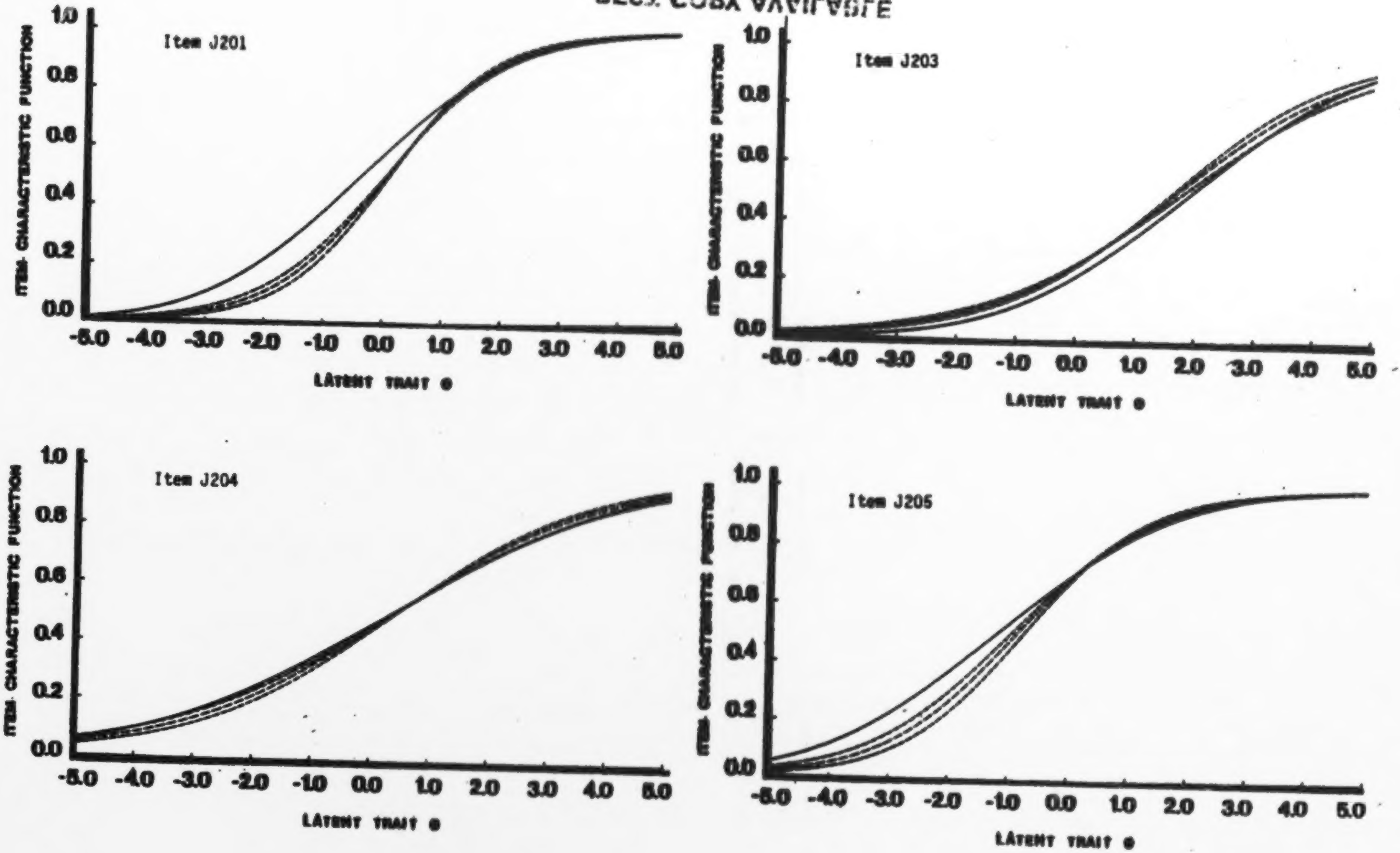

FIGURE 9-4

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the J1-J2 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J2.

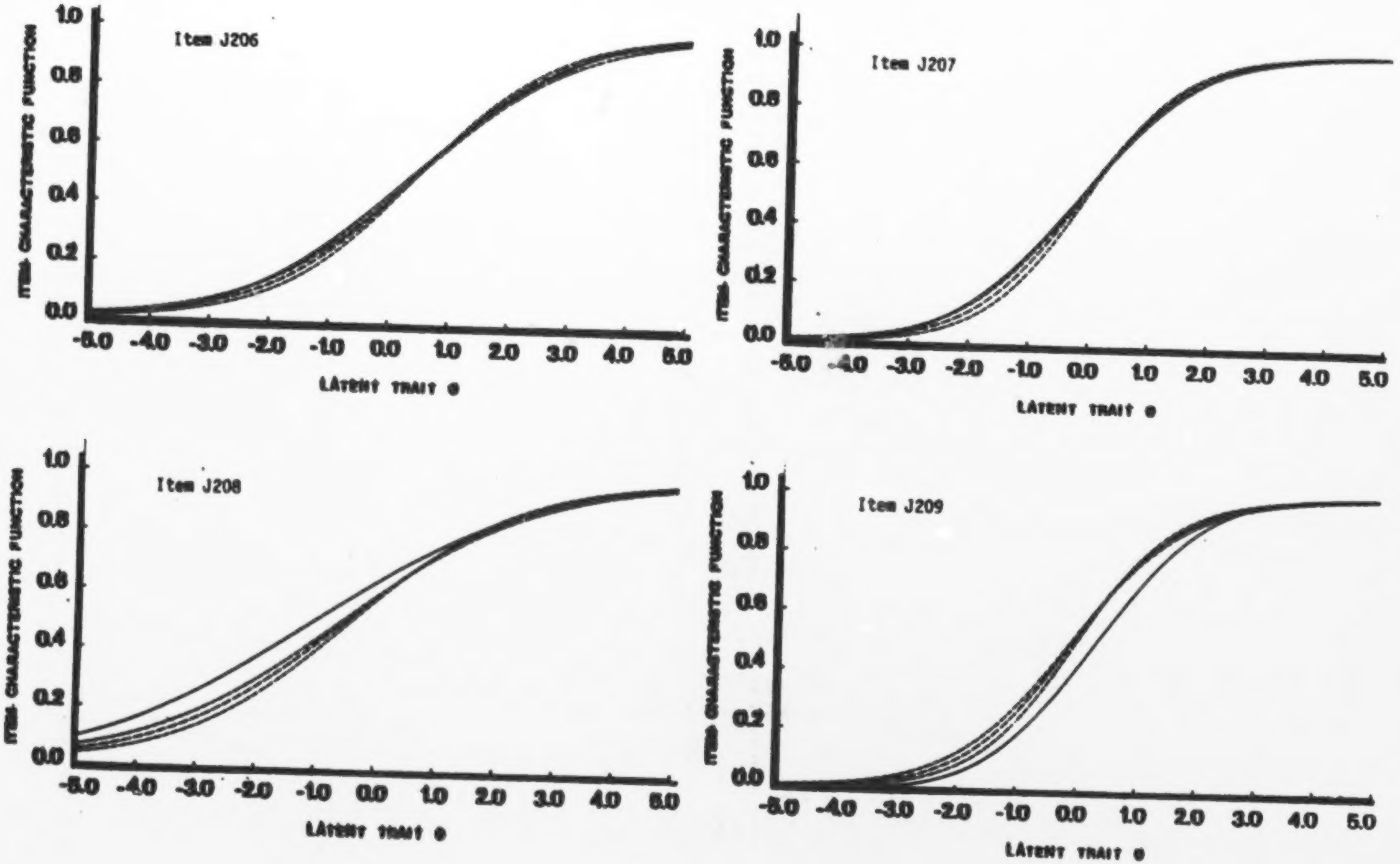

FIGURE 9-4 (Continued)

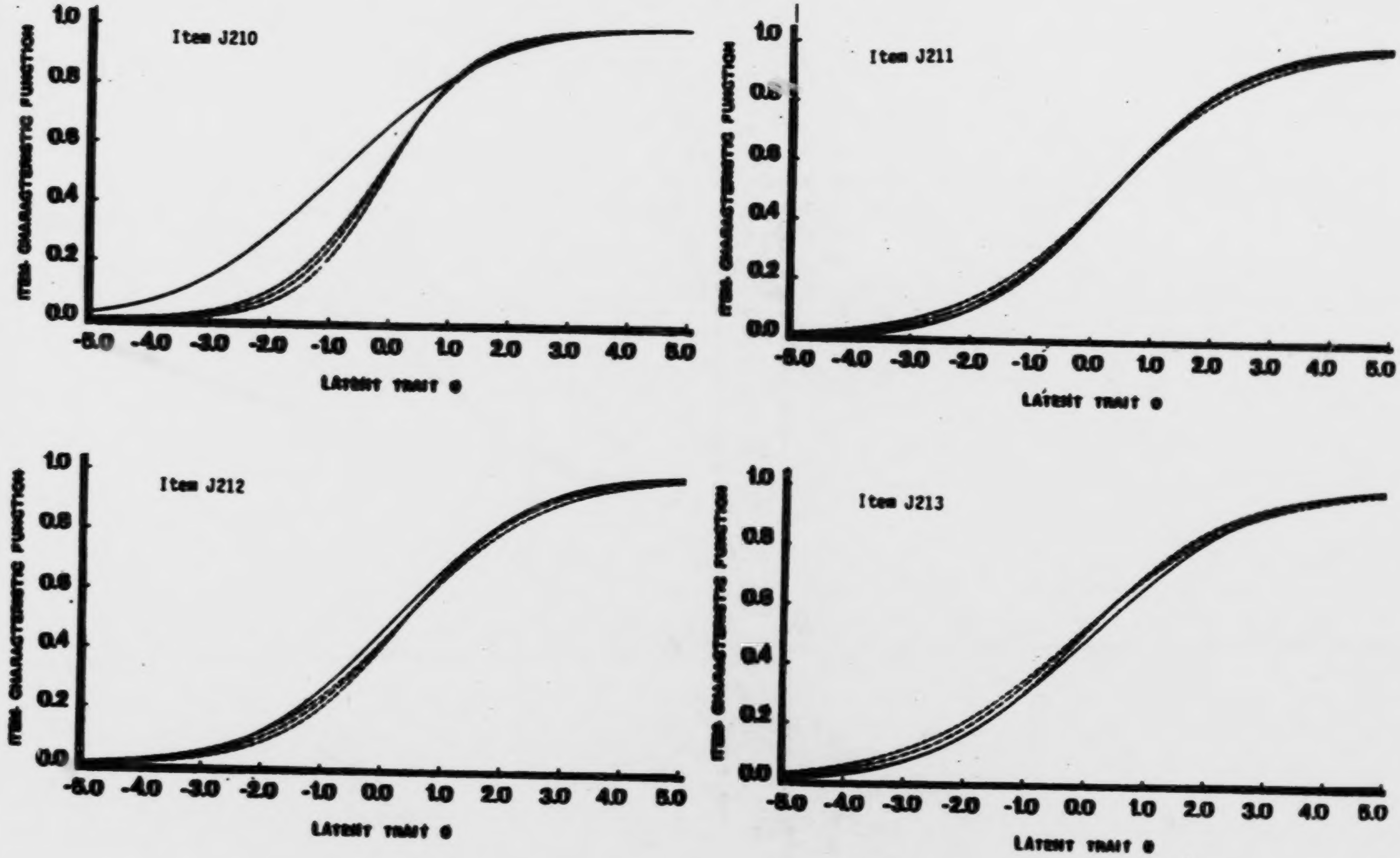

FIGURE 9-4 (Continued)

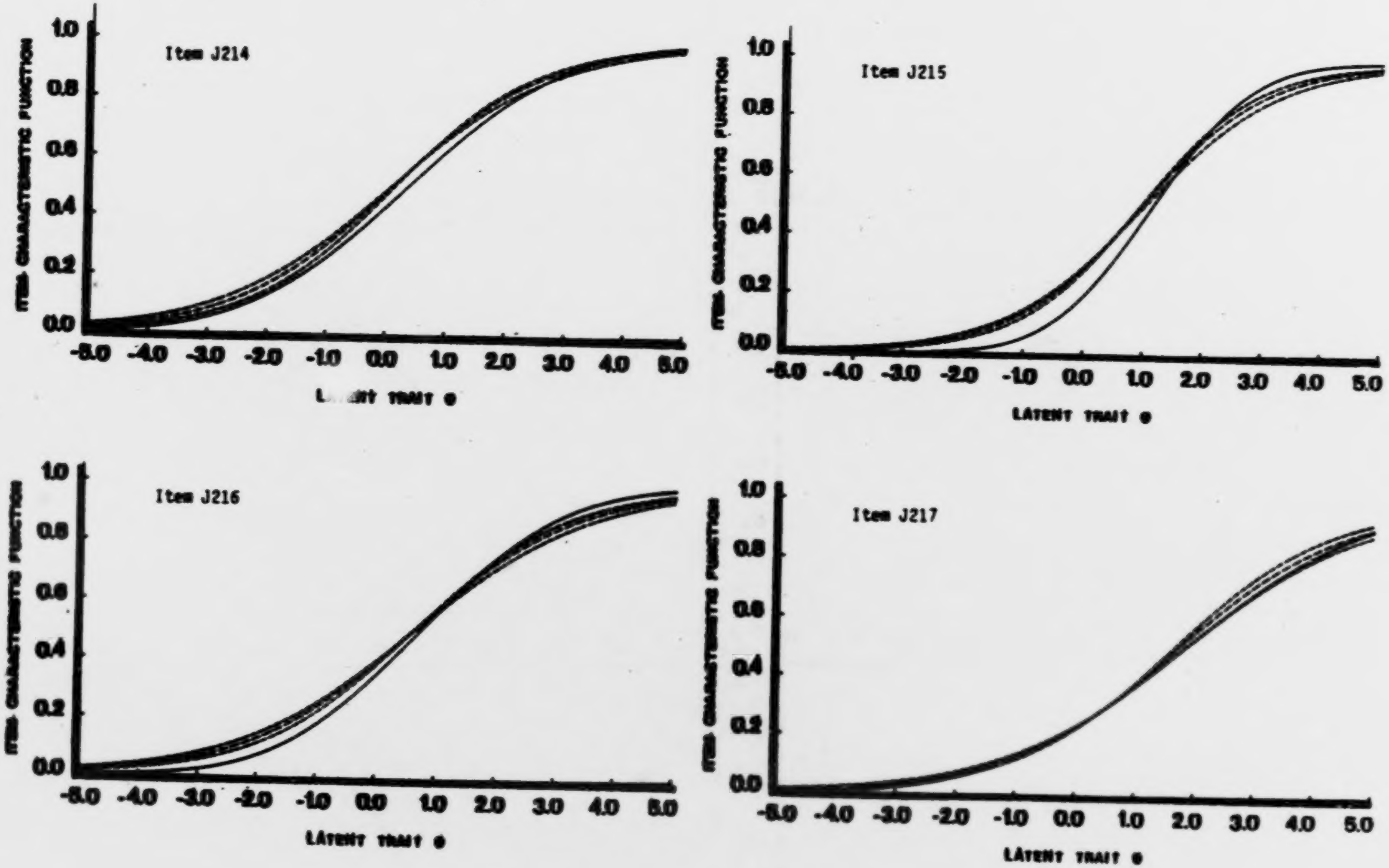

FIGURE 9-4 (Continued)

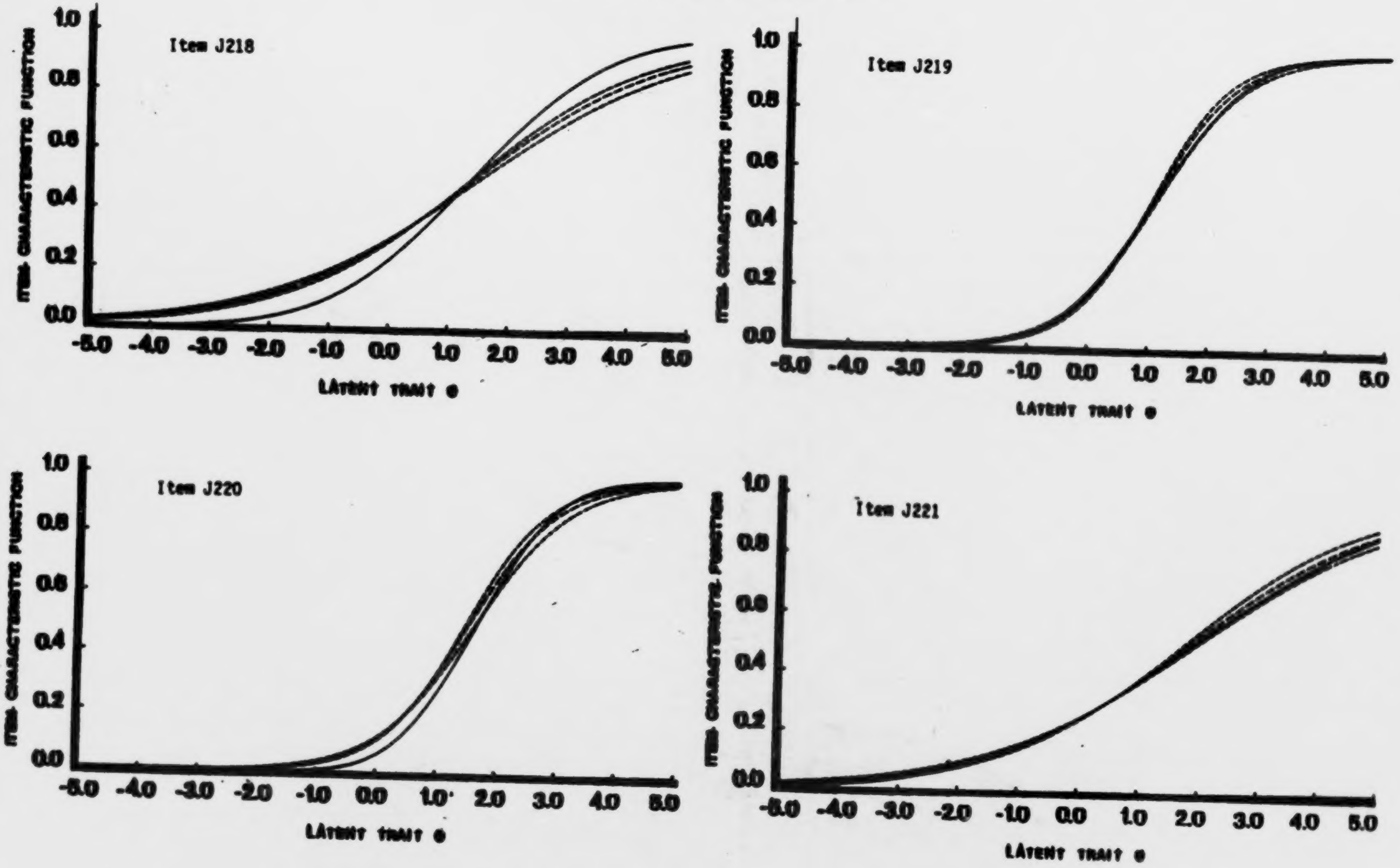

FIGURE 9-4 (Continued)

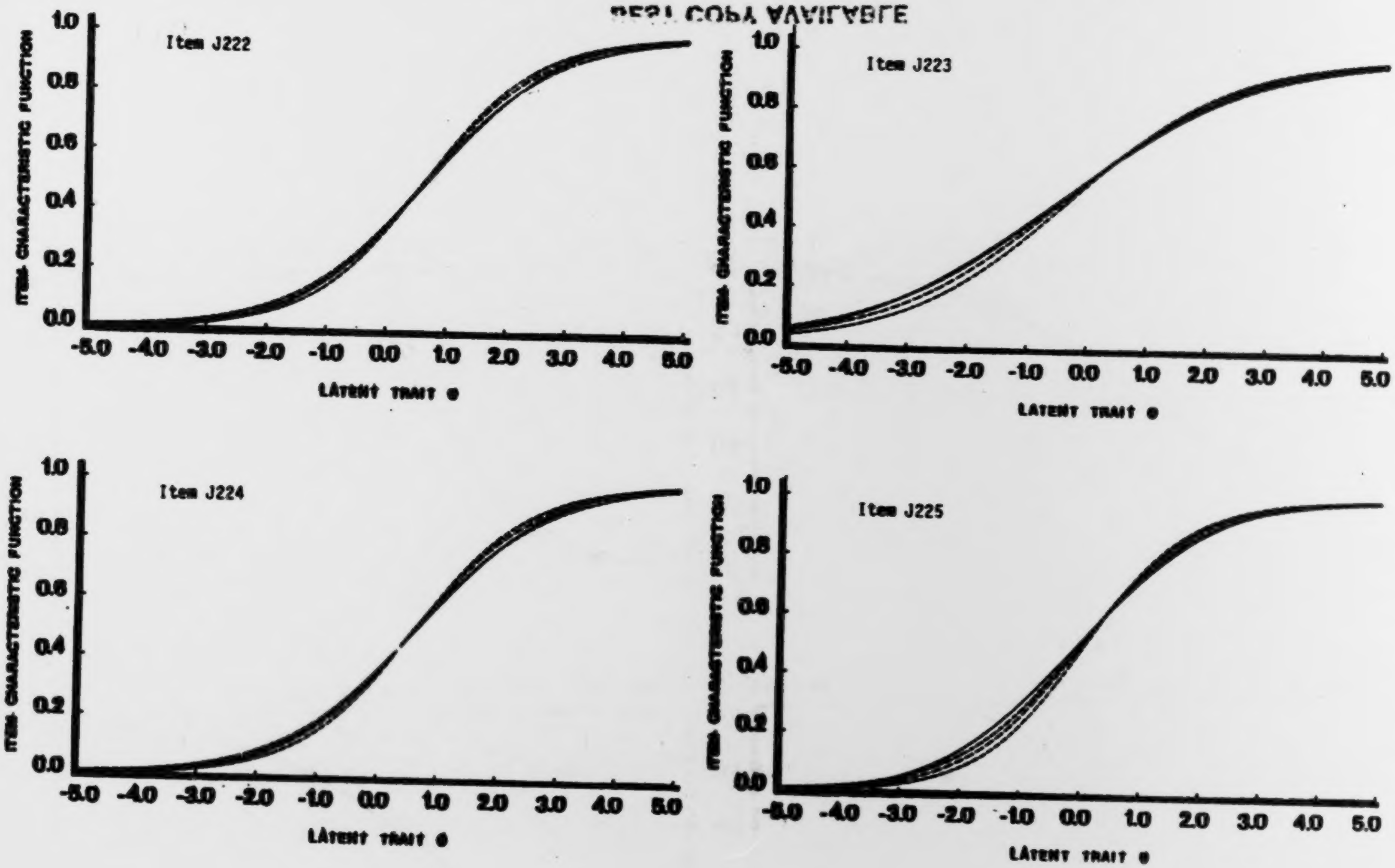

FIGURE 9-4 (Continued)

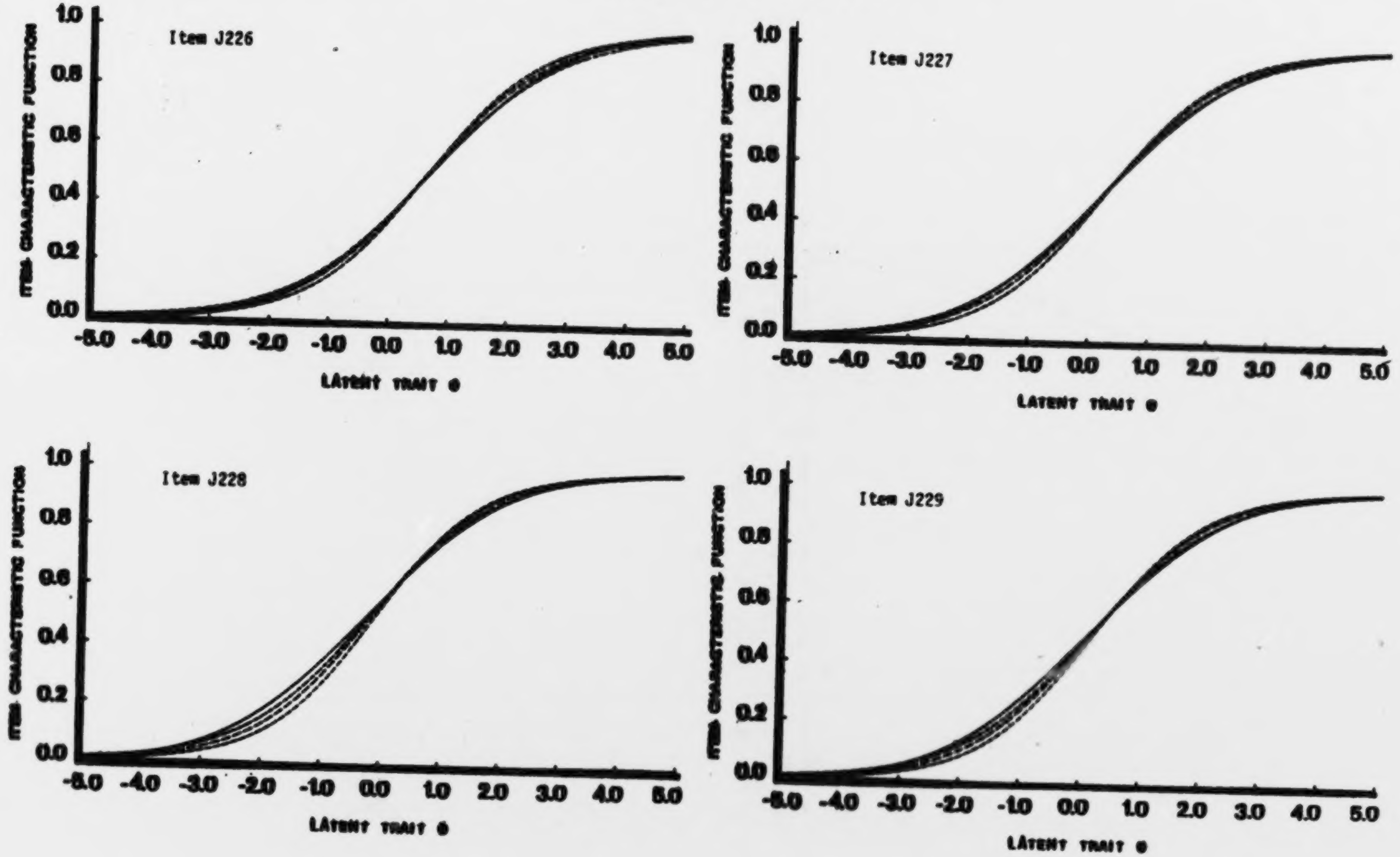

FIGURE 9-4 (Continued)

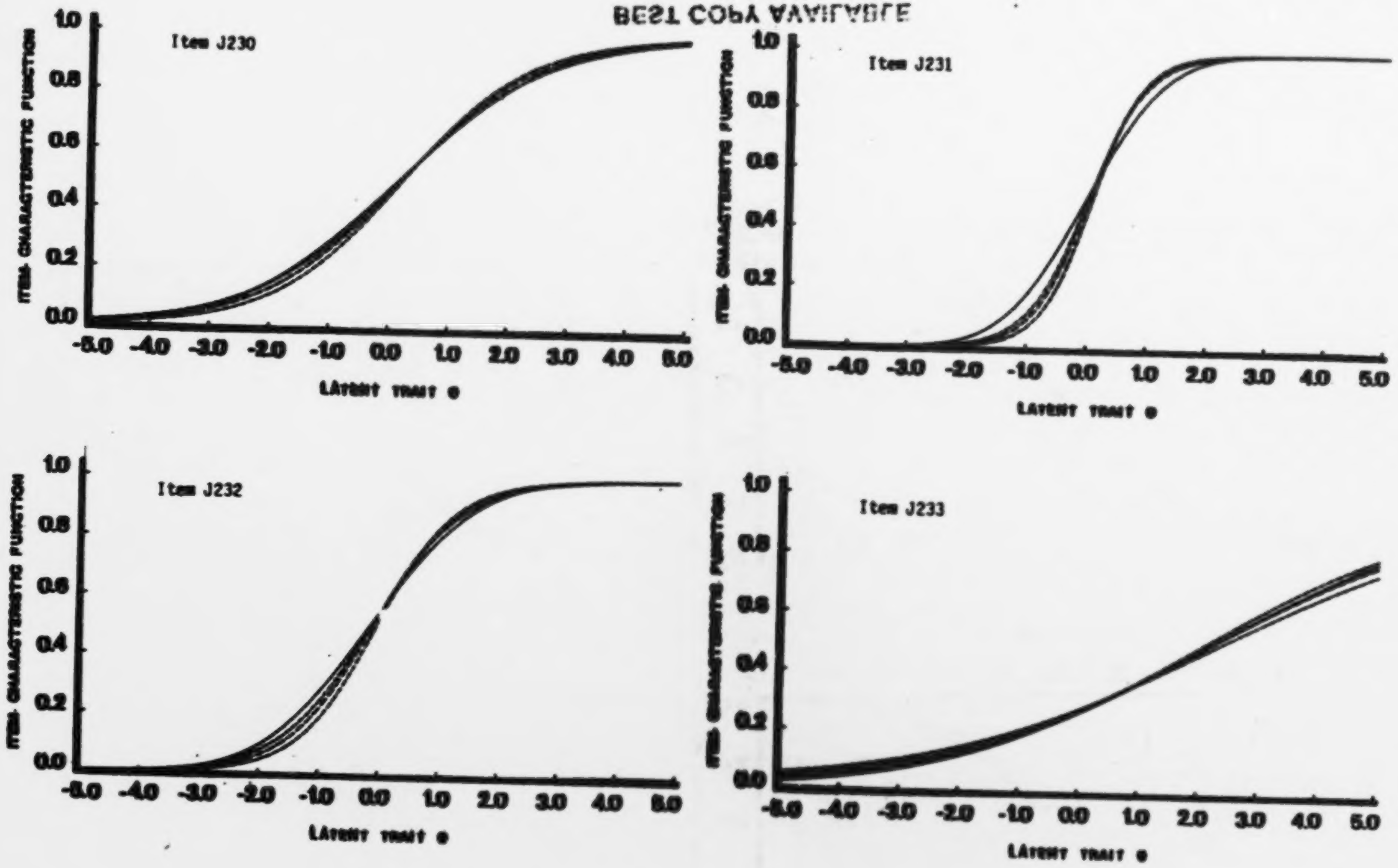

FIGURE 9-4 (Continued)

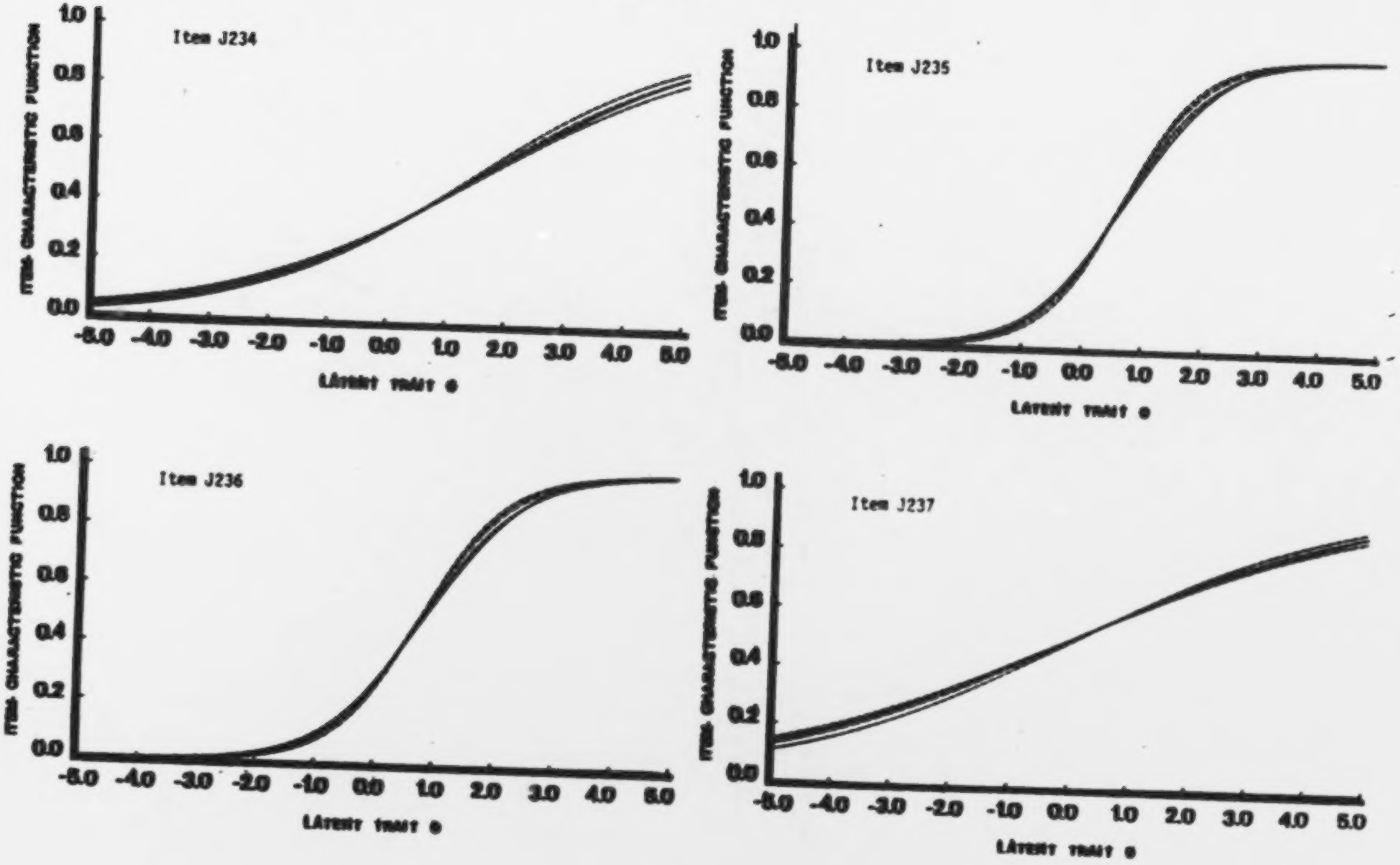

FIGURE 9-4 (Continued)

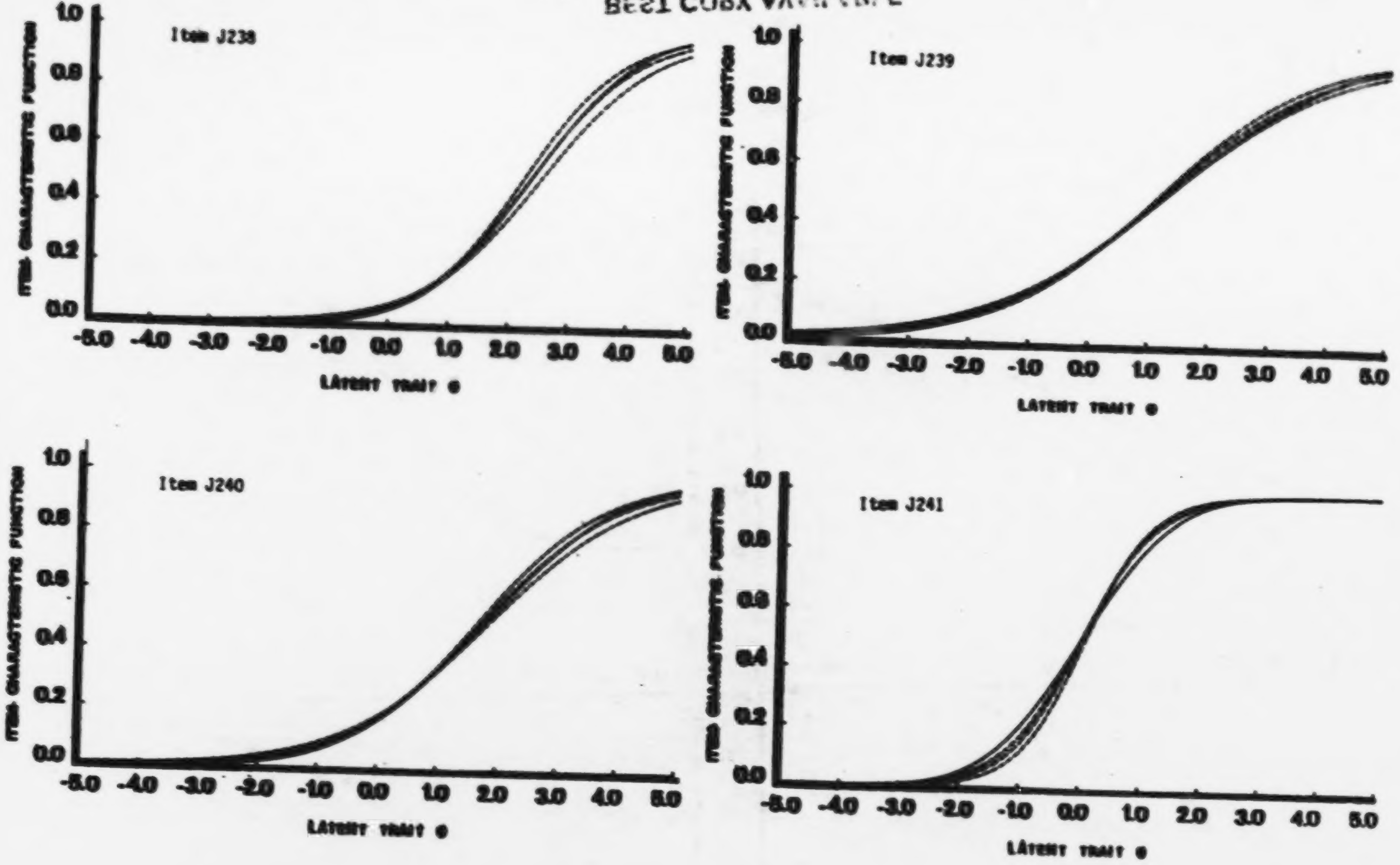

FIGURE 9-4 (Continued)

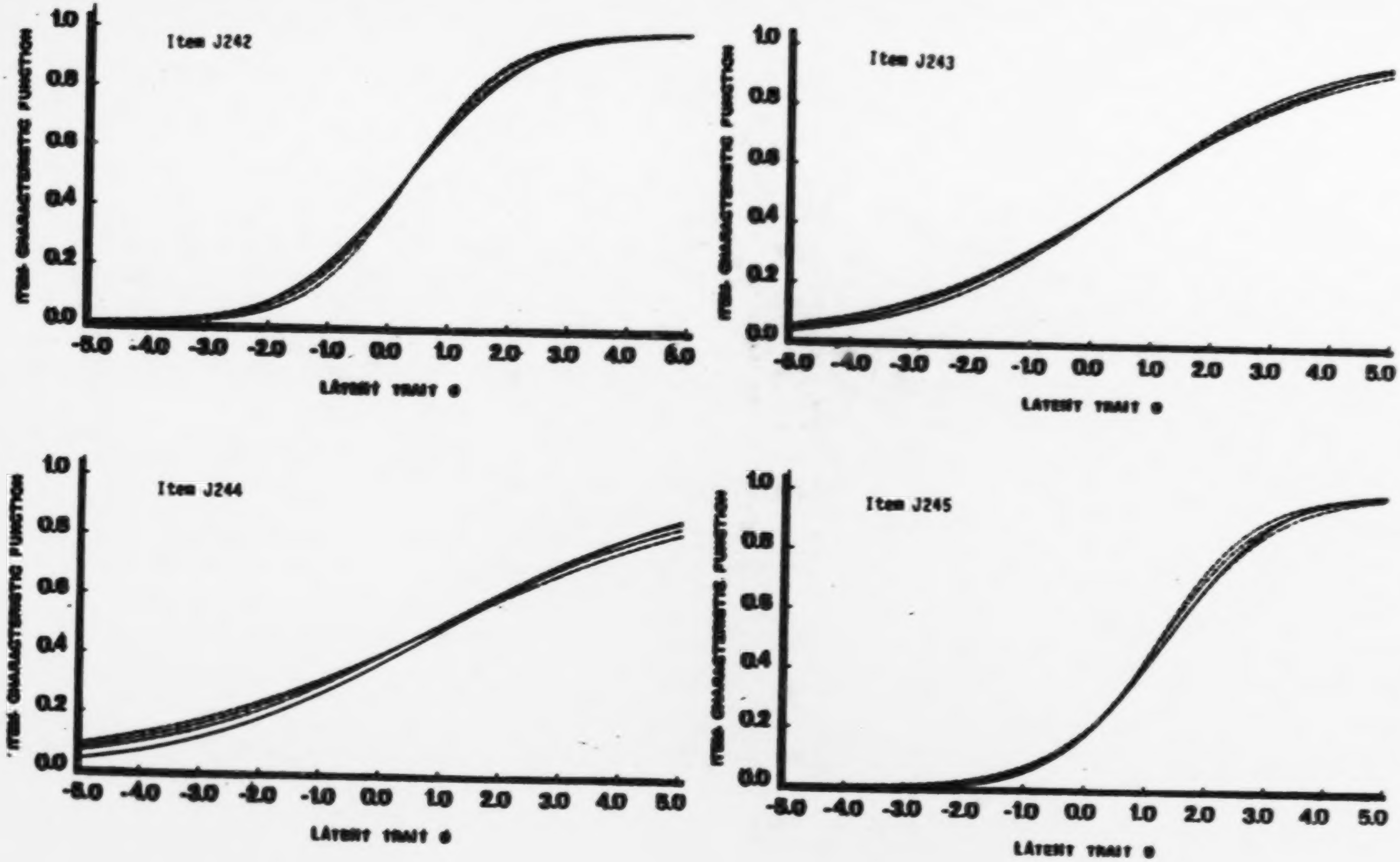

FIGURE 9-4 (Continued)

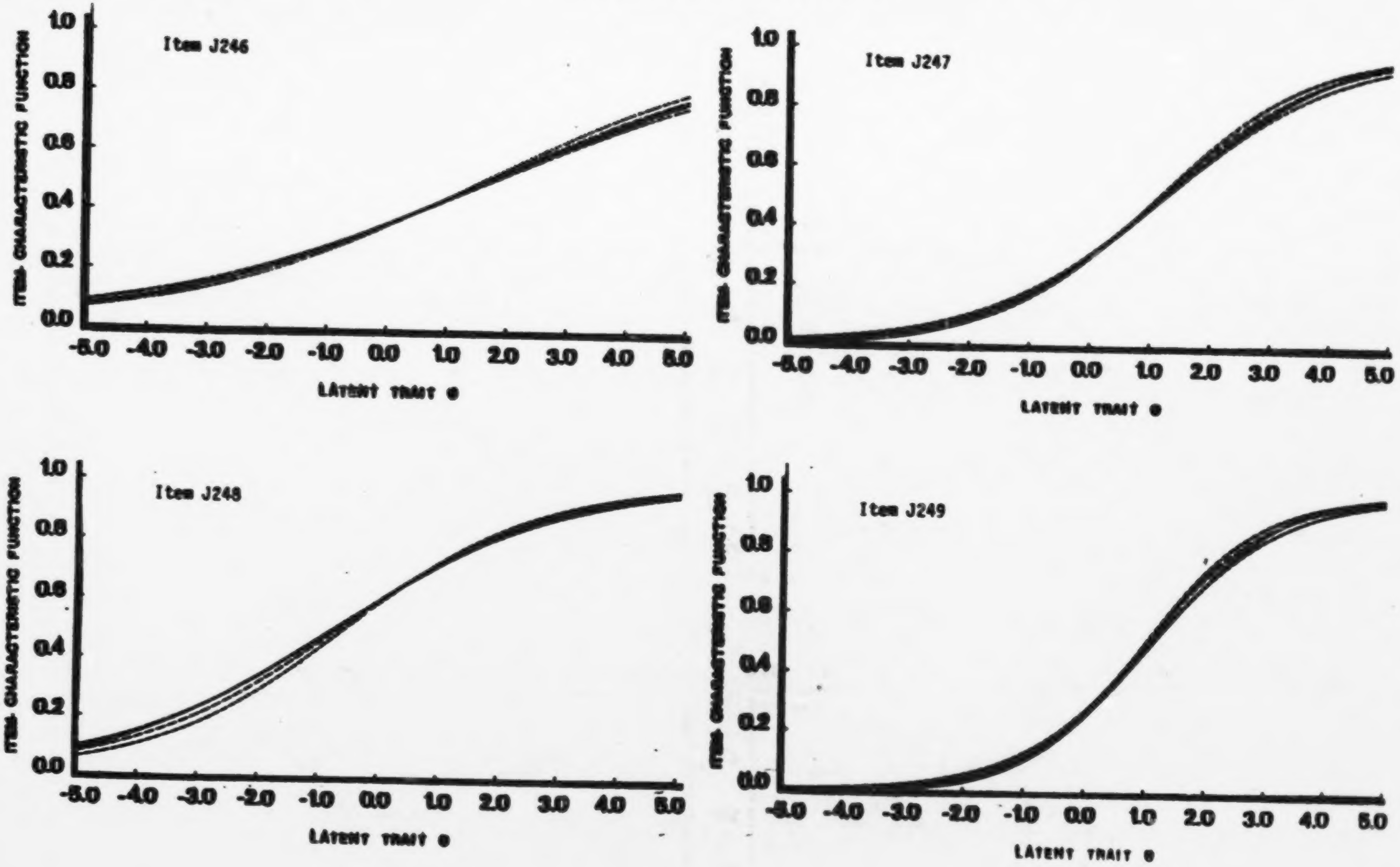

FIGURE 9-4 (Continued)

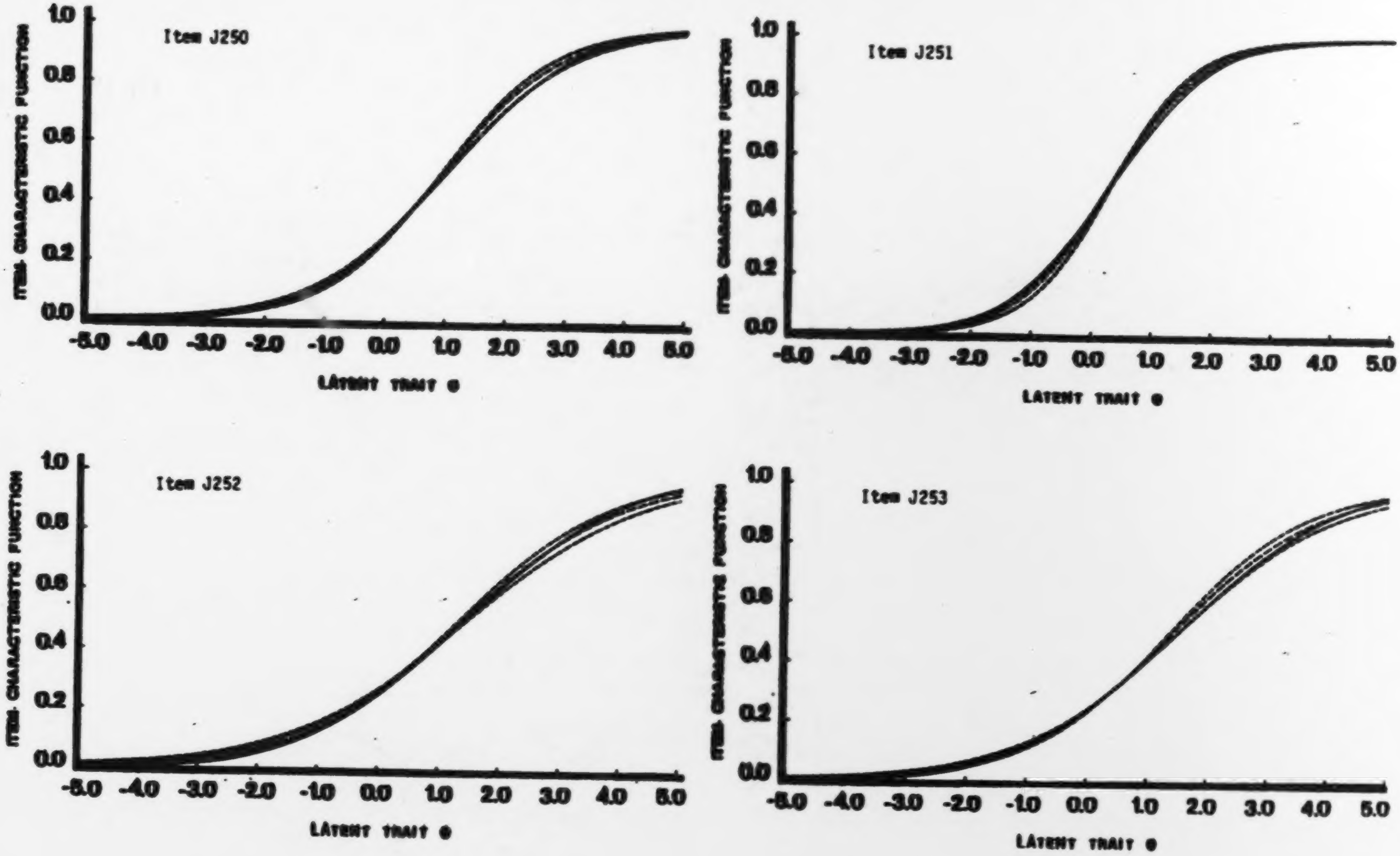

FIGURE 9-4 (Continued)

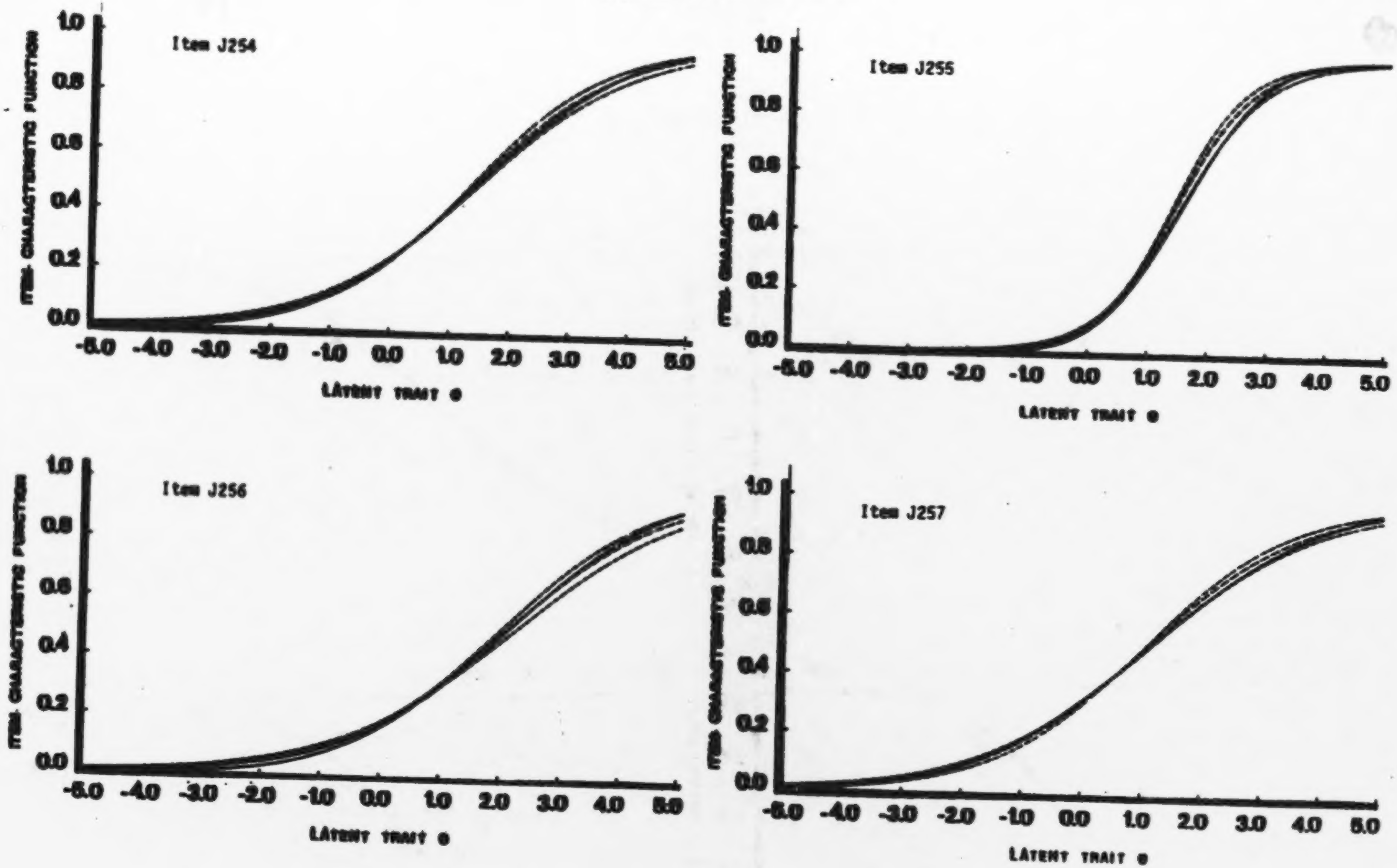

FIGURE 9-4 (Continued)

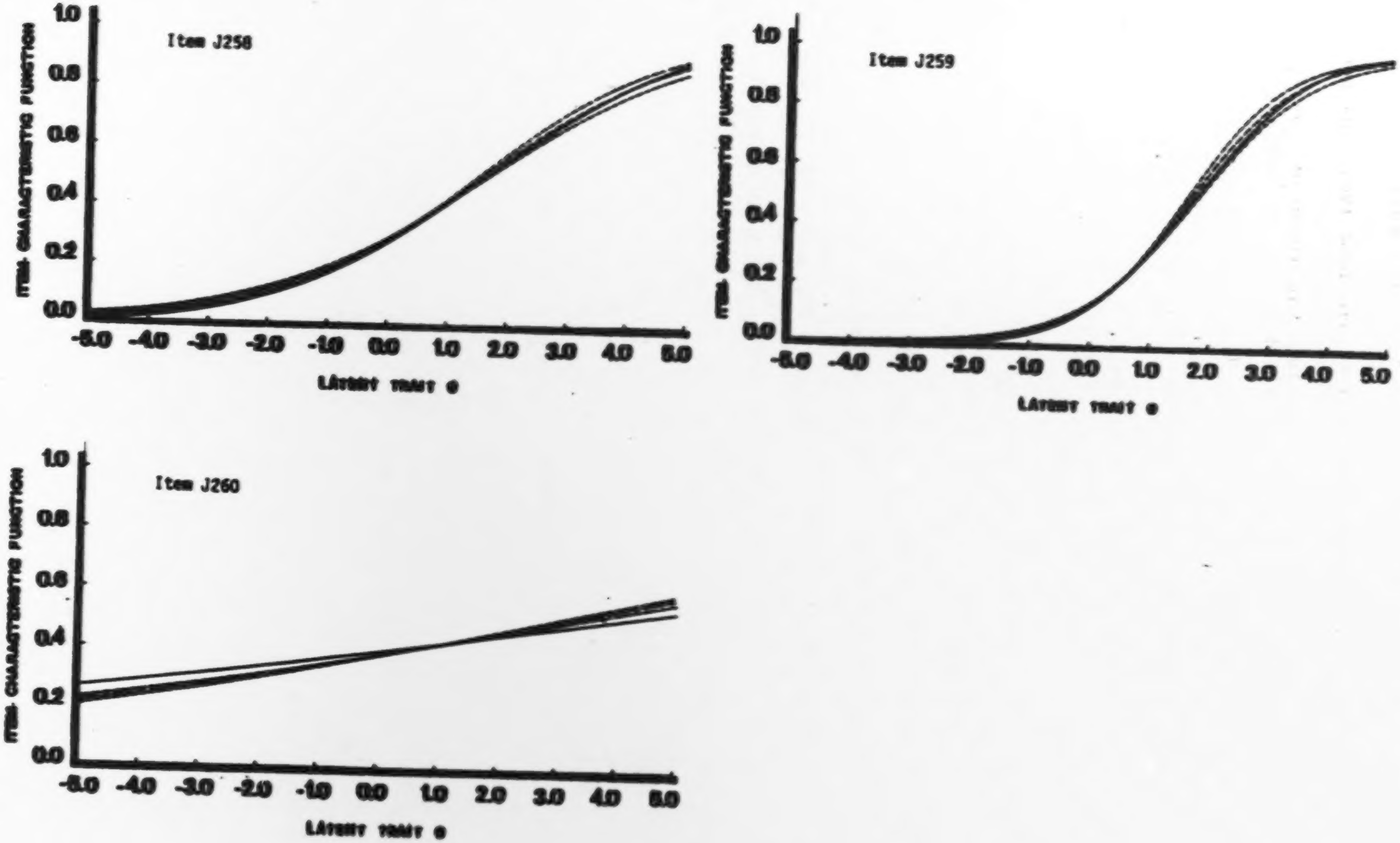

FIGURE 9-4 (Continued)

estimated item characteristic function is in the normal ogive model, and the other four are in the (two-parameter) logistic model. We notice that there are basically two sets of estimated item parameters which were obtained by Logist 5, i.e., one based upon either Case A5-A6 or Case J1-J2 and the other upon Case A5-A6-J1-J2. For brevity, hereafter, we shall call the former approach Method A and the latter Method B. In each of these two cases the estimated item parameters were adjusted twice, i.e., first on the assumption that the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of $\theta$, and, secondly, without this assumption. These adjusted estimated item parameters in the first situation are given in Tables 7-13 through 7-20, and those in the second situation are shown in Tables 8-3 through 8-10, respectively, for the items of Tests A5, A6, J1 and J2. In each graph of Figures 9-1 through 9-4, the results based upon Method A and upon the first and the second scale adjustments are drawn by a long dashed line and a short dashed line, respectively, and those based upon Method B and upon the first and the second adjustments are shown by a dashed line of medium length and dotted line, respectively.

From these results, we can say the following.

(1) For many items, the two Logist 5 results based upon the second scale adjustment are close to each other, while those based upon the first scale adjustment are substantially different from each other.

(2) In addition to the above, the two Logist 5 results based upon

the second scale adjustment also tend to be closer to the result of Tetrachoric Method.

These two findings seem to justify the second scale adjustment, and also to support the consistency in the results of the two methods, i.e., Tetrachoric Method and Logist 5 .

Figures 9-5 and 9-6 present the results of J1/1075 and J1/2259 Cases for each item of Test J1. Again in each of these graphs a solid curve represents the estimated item characteristic function in the normal ogive model, whose item parameters were originally obtained by Tetrachoric Method and then adjusted, and presented in Tables 6-8 and 6-9. The other four curves are based upon the estimated item parameters obtained by Logist 5 , with two of them by assuming (two-parameter) logistic model and the other two by assuming three-parameter logistic model. The results in the (two-parameter) logistic model with the first and the second scale adjustments, whose estimated item parameters are shown in Tables 7-21 or 7-23 and in Table 8-11 or 8-13, are drawn by a long dashed line and a short dashed line, respectively; the results obtained by assuming three-parameter logistic model with the first and second scale adjustments, whose estimated item parameters are presented in Table 7-22 or 7-24, and in Table 8-12 or 8-14, are shown by a dashed line of medium length and a dotted line, respectively.

From these results we can find the following.

(3) For many items the logistic curve obtained with the second scale adjustment, which is shown by a short dashed line, is very

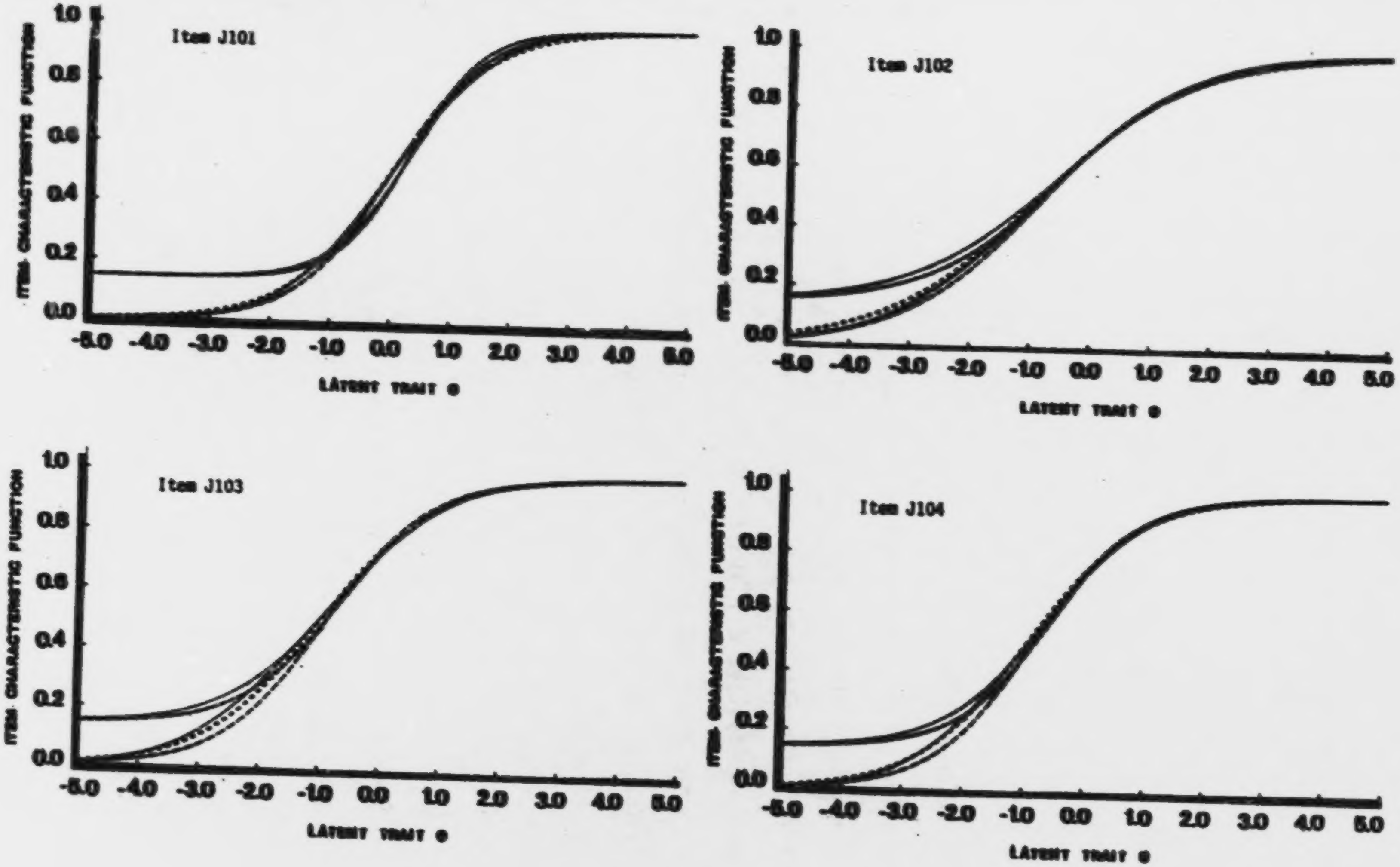

FIGURE 9-5

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Two Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And Two Estimated Item Characteristic Functions Following the Three-Parameter Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1. Results of the J1/1075 Case.

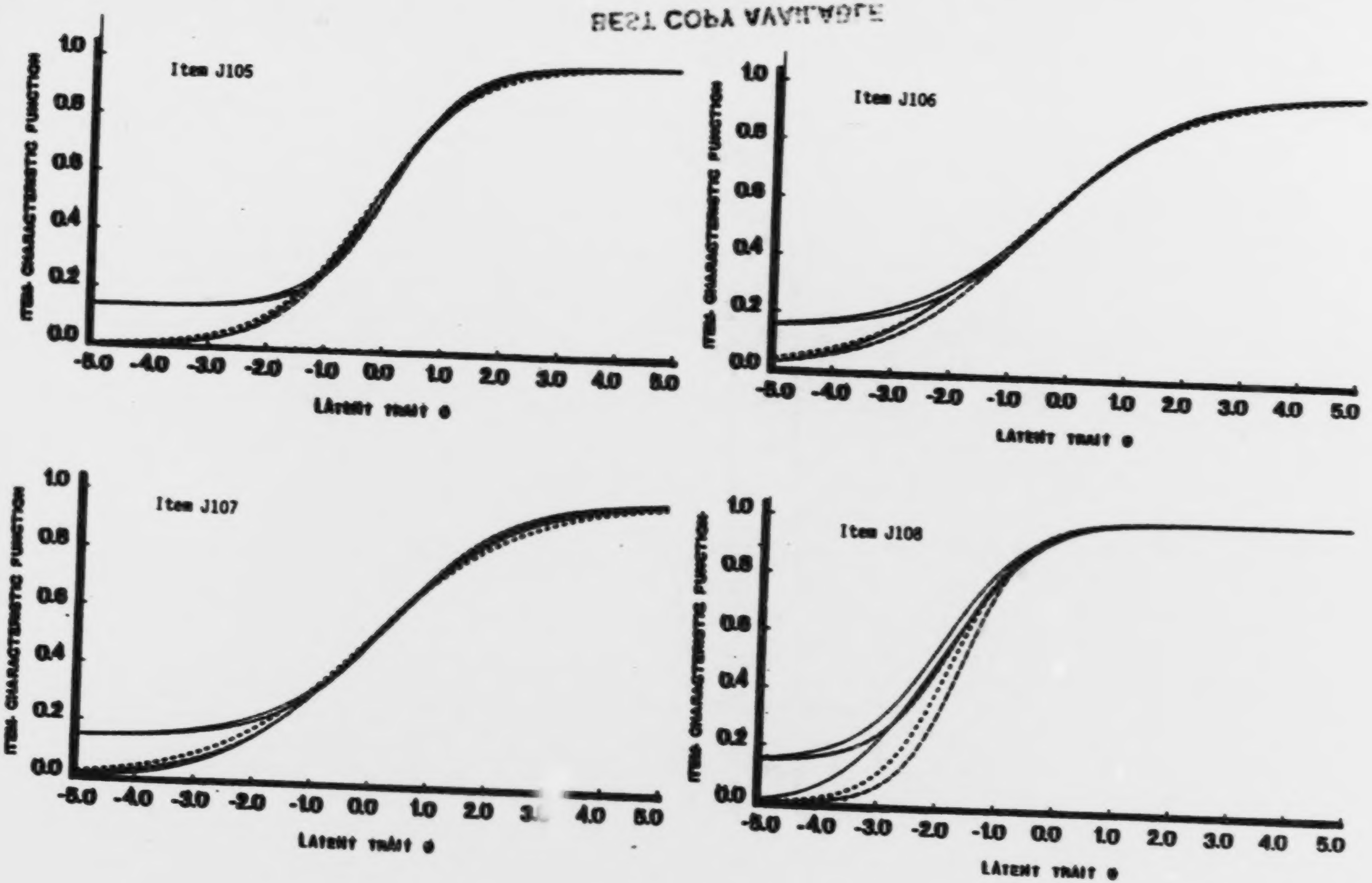

FIGURE 9-5 (Continued)

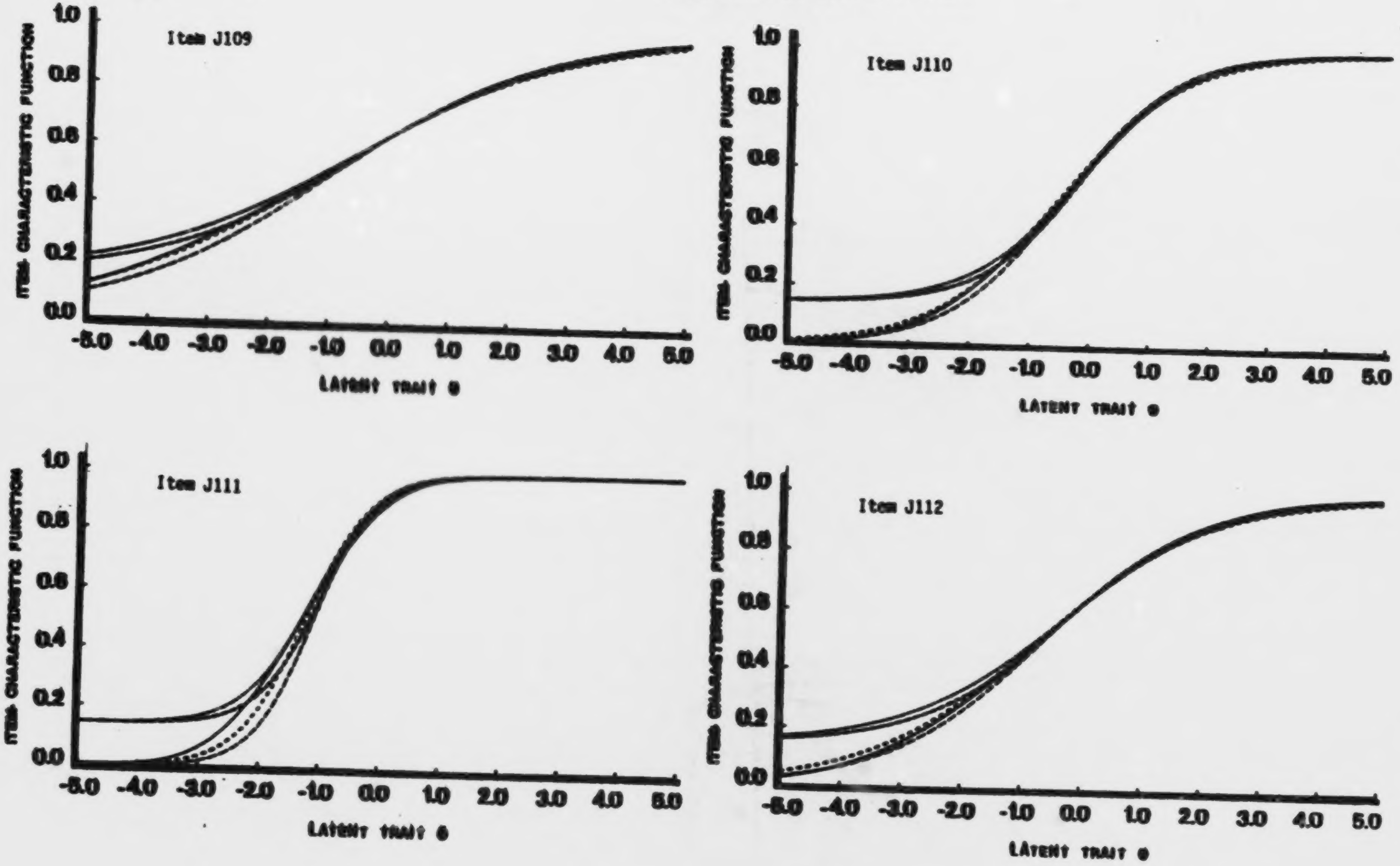

FIGURE 9-5 (Continued)

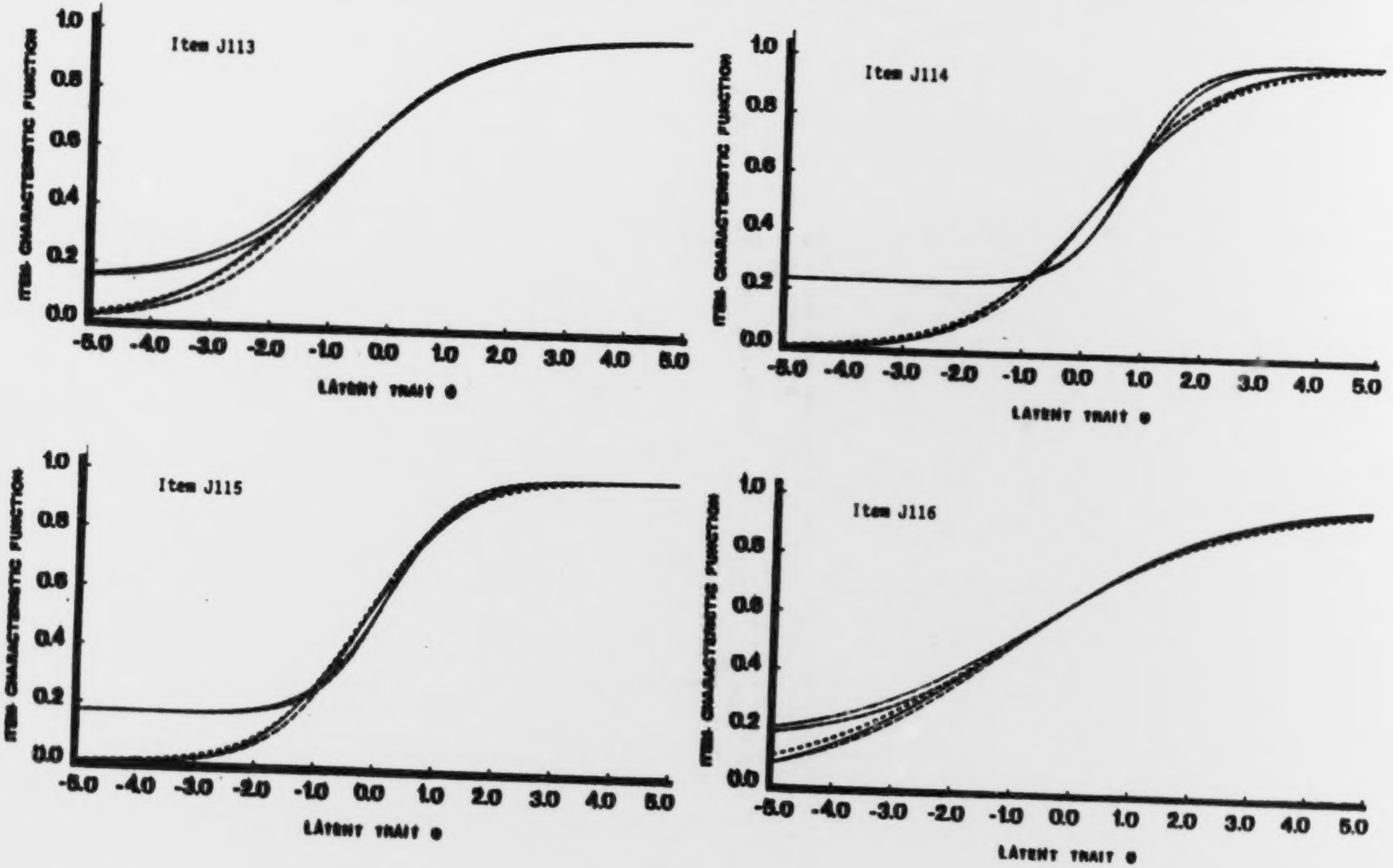

FIGURE 9-5 (Continued)

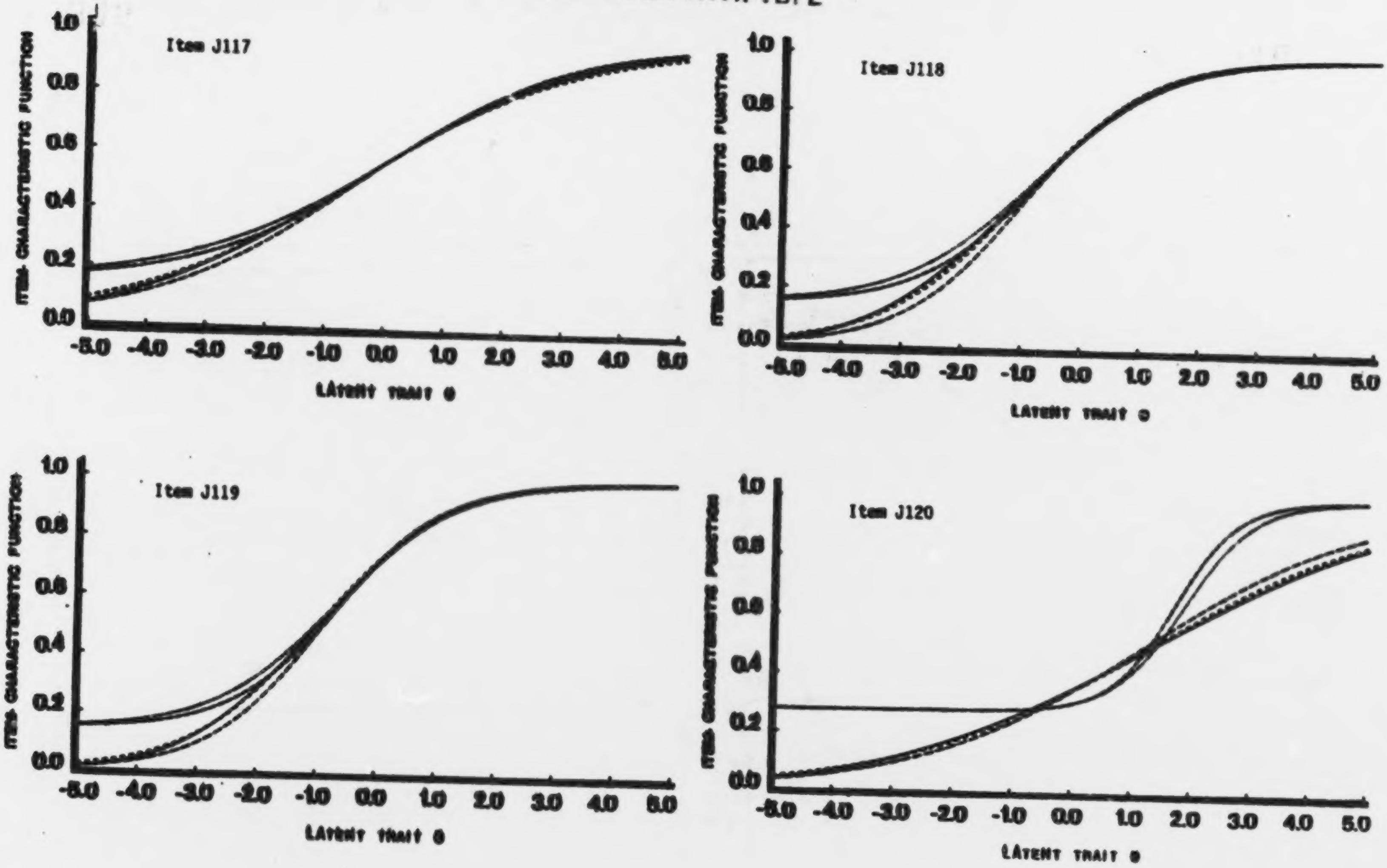

FIGURE 9-5 (Continued)

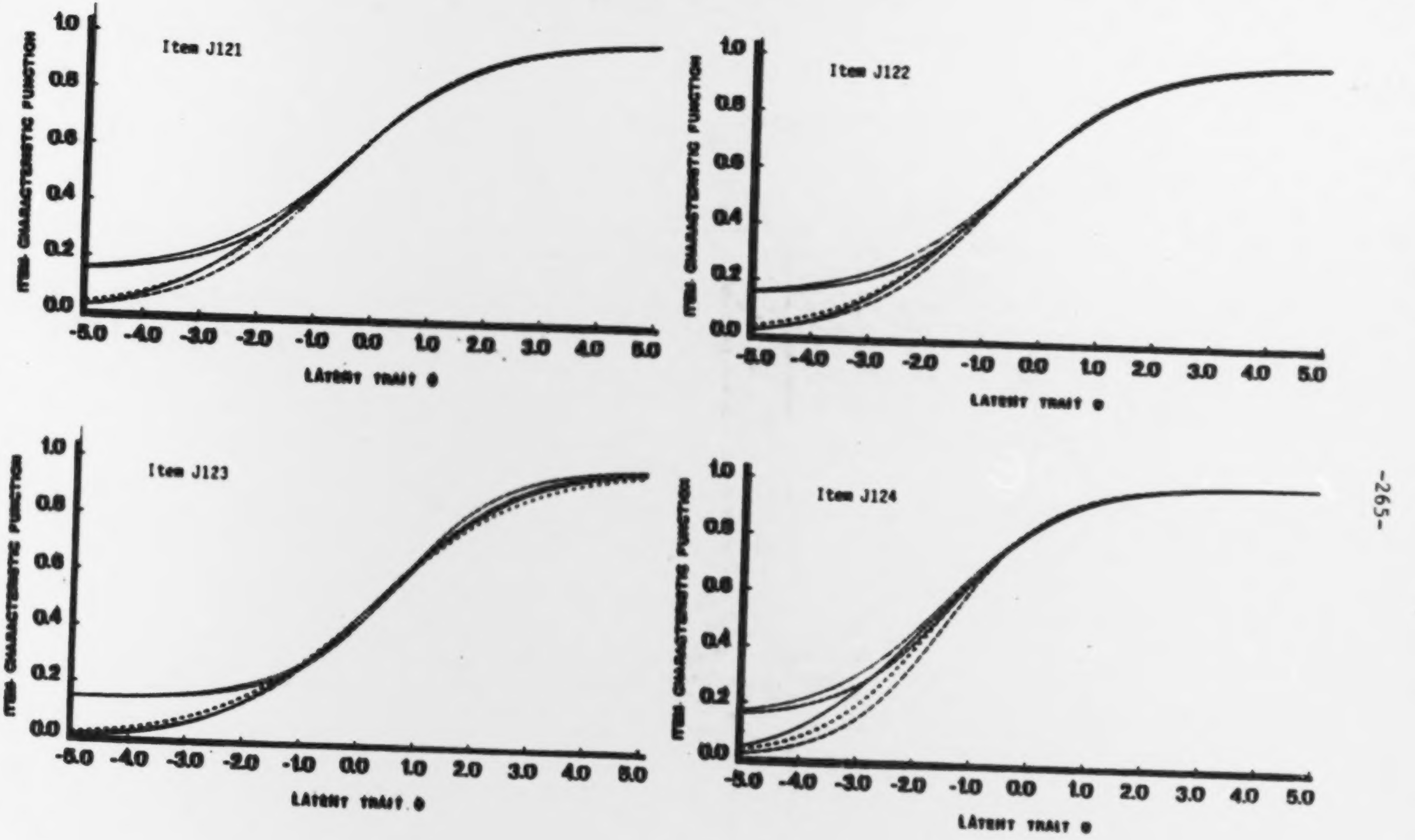

FIGURE 9-5 (Continued)

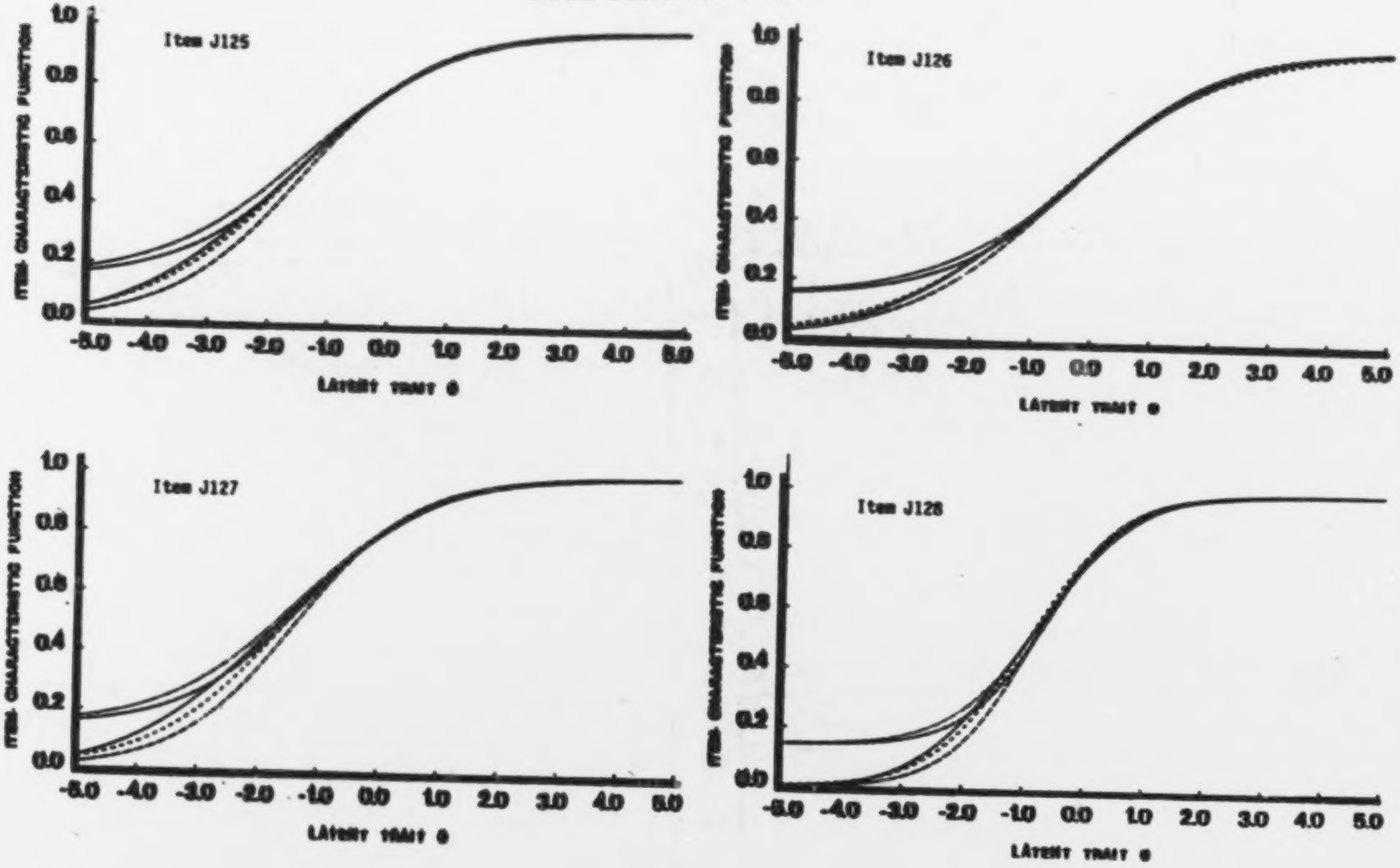

FIGURE 9-5 (Continued)

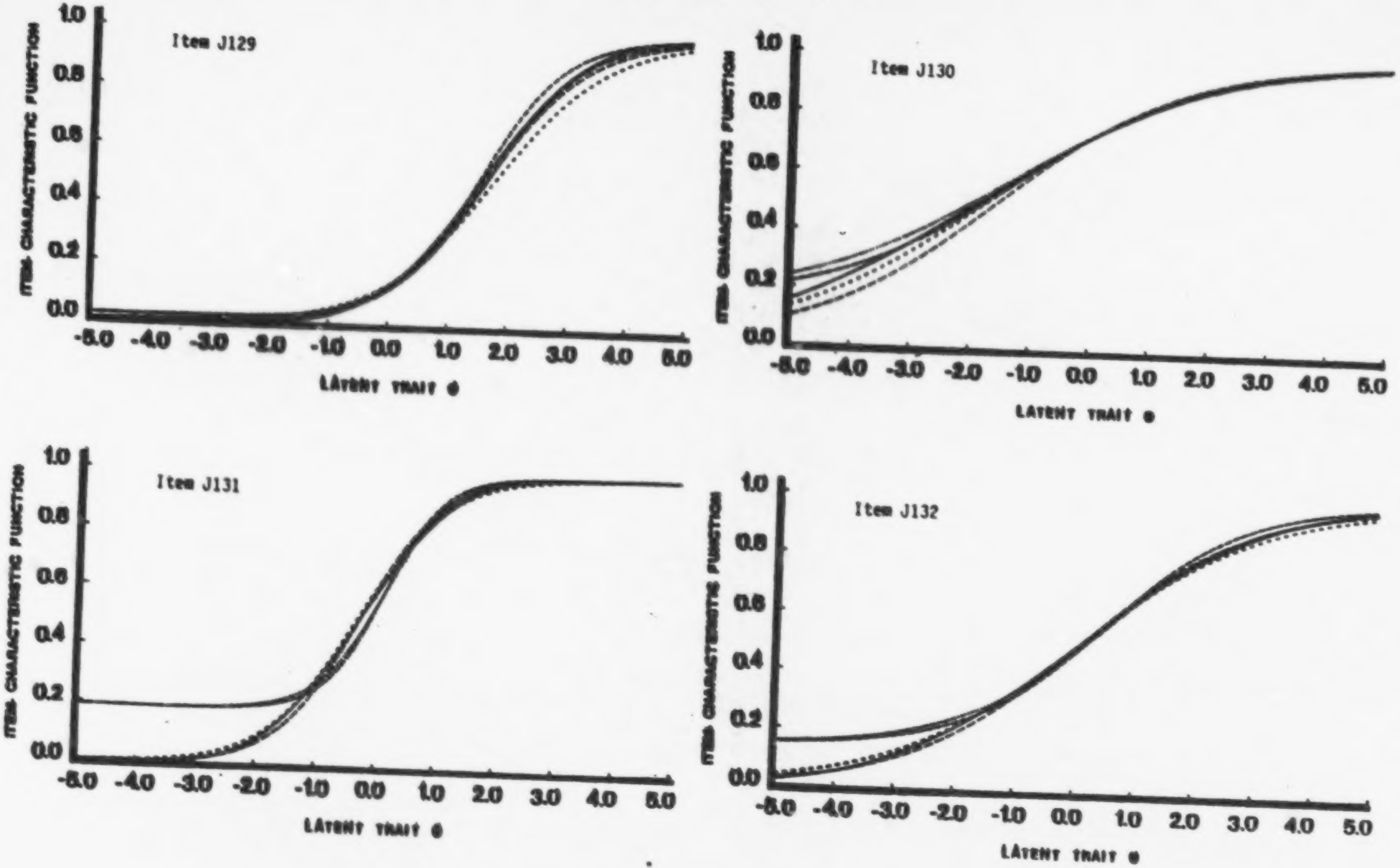

FIGURE 9-5 (Continued)

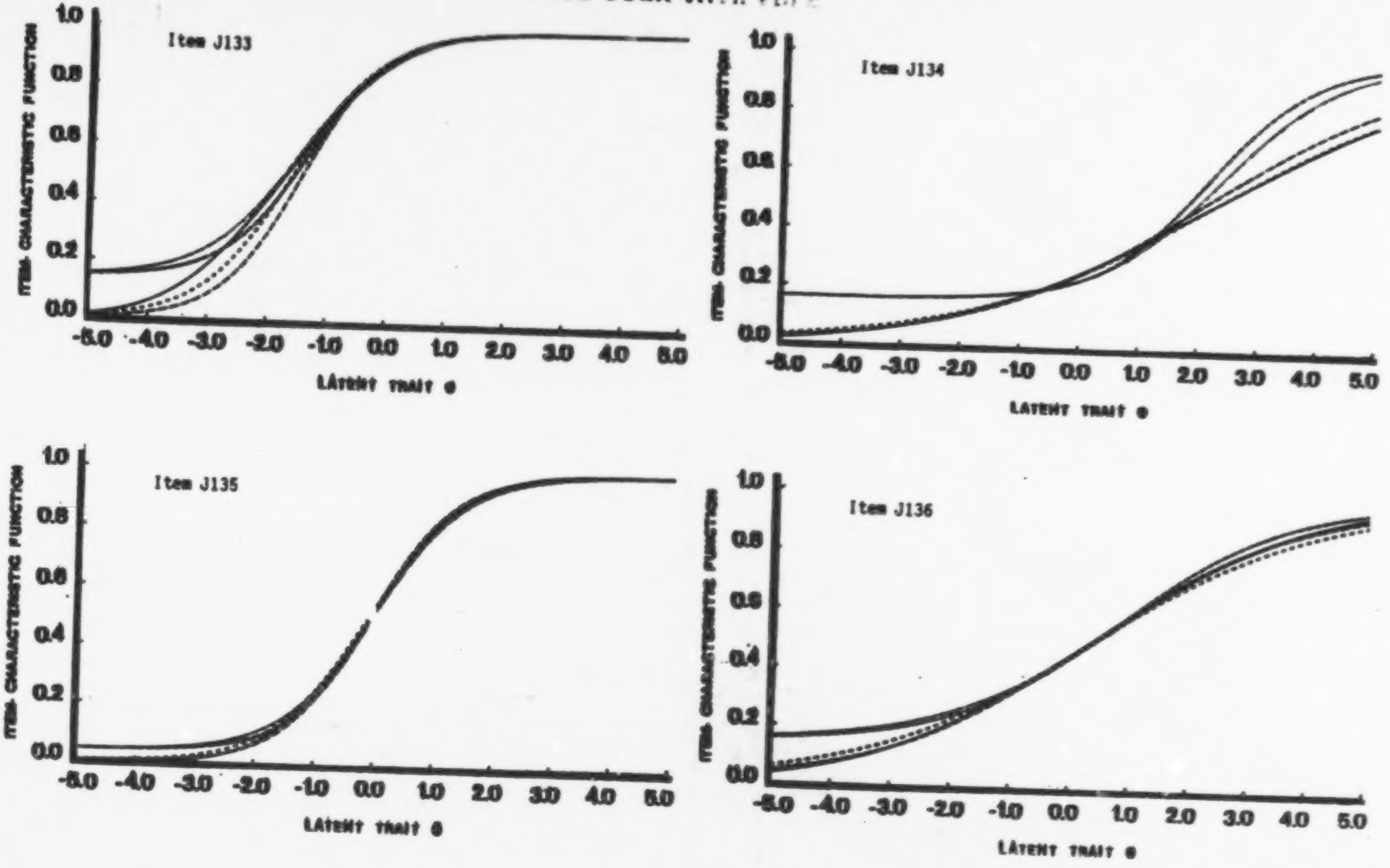

FIGURE 9-5 (Continued)

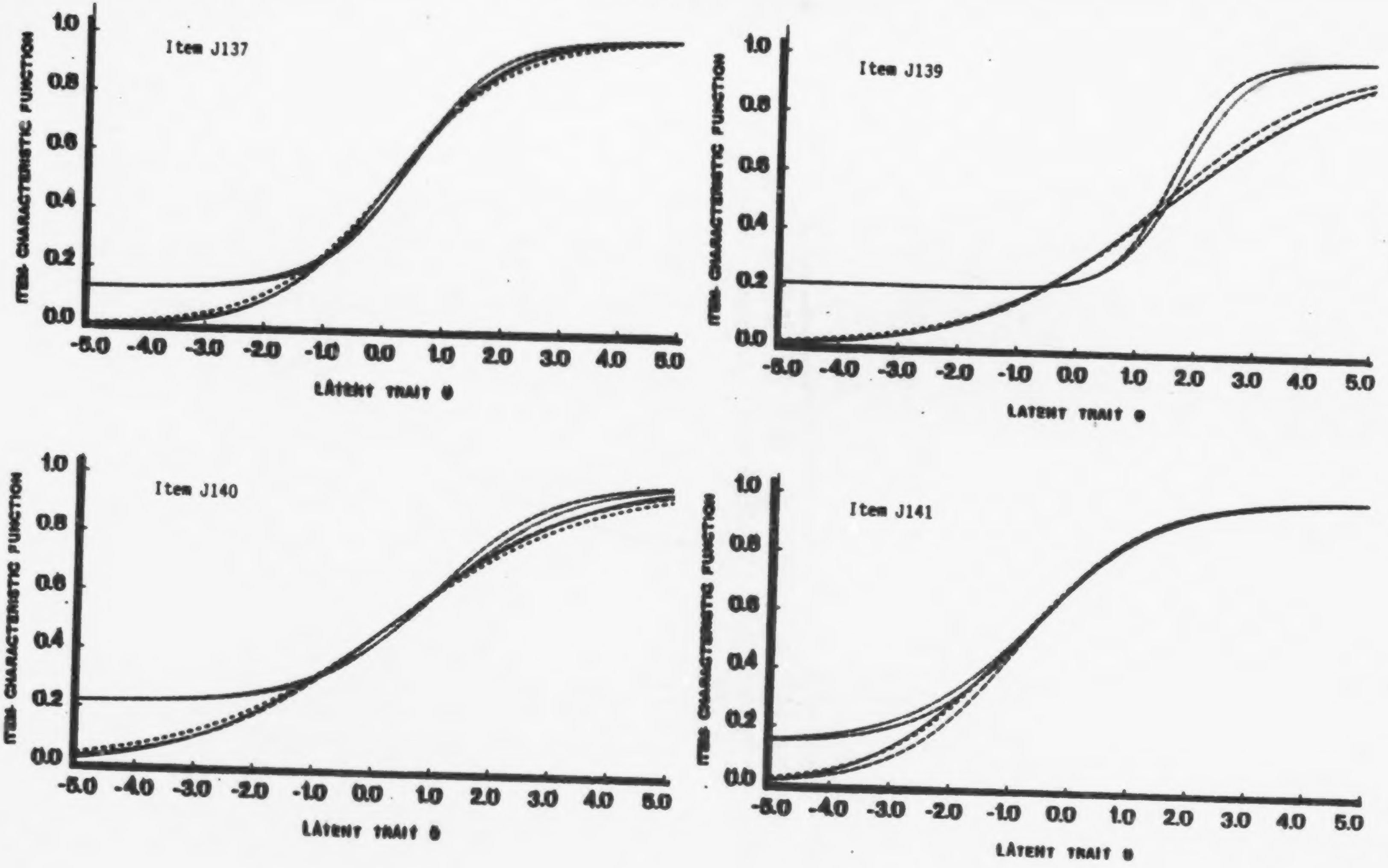

FIGURE 9-5 (Continued)

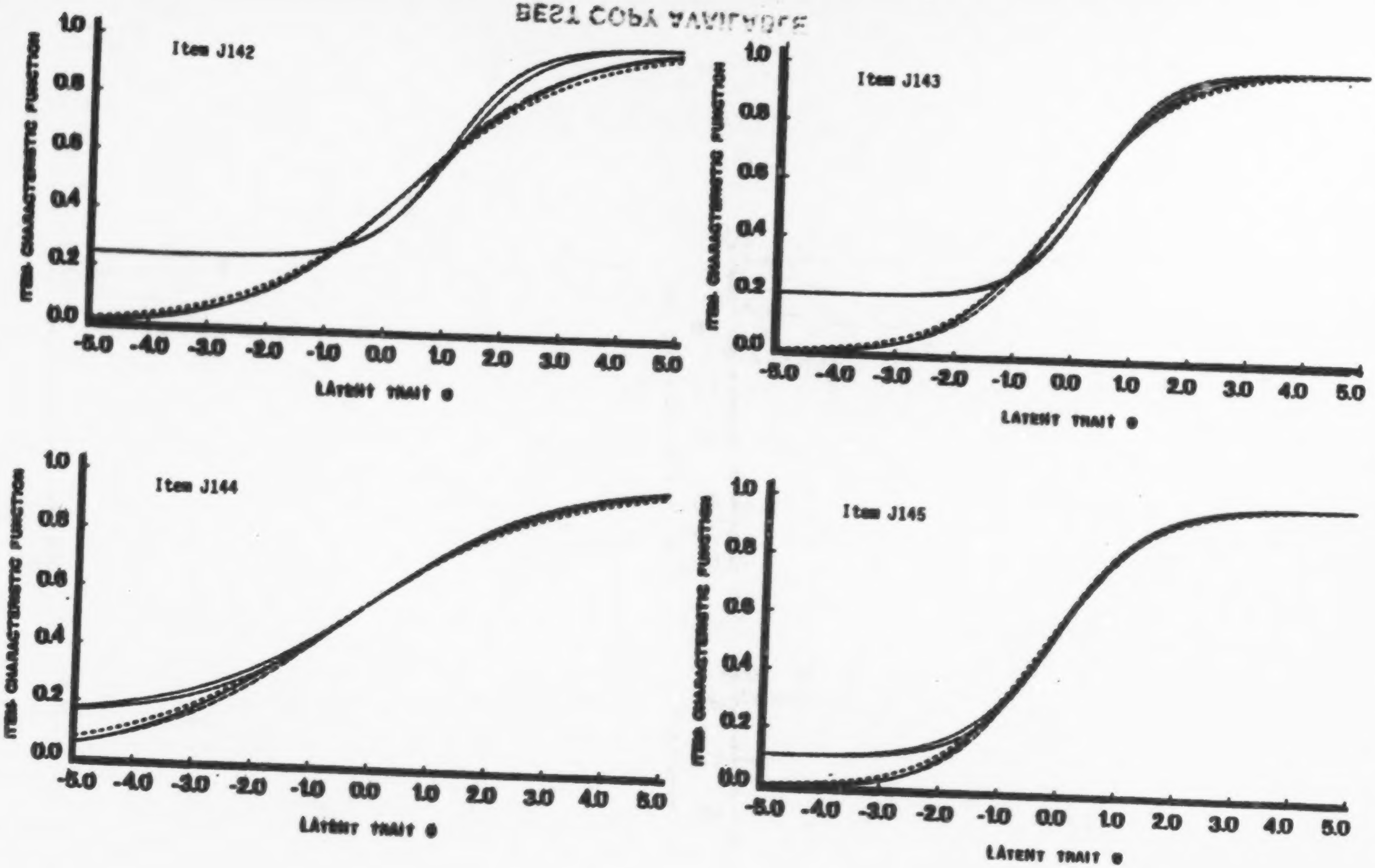

FIGURE 9-5 (Continued)

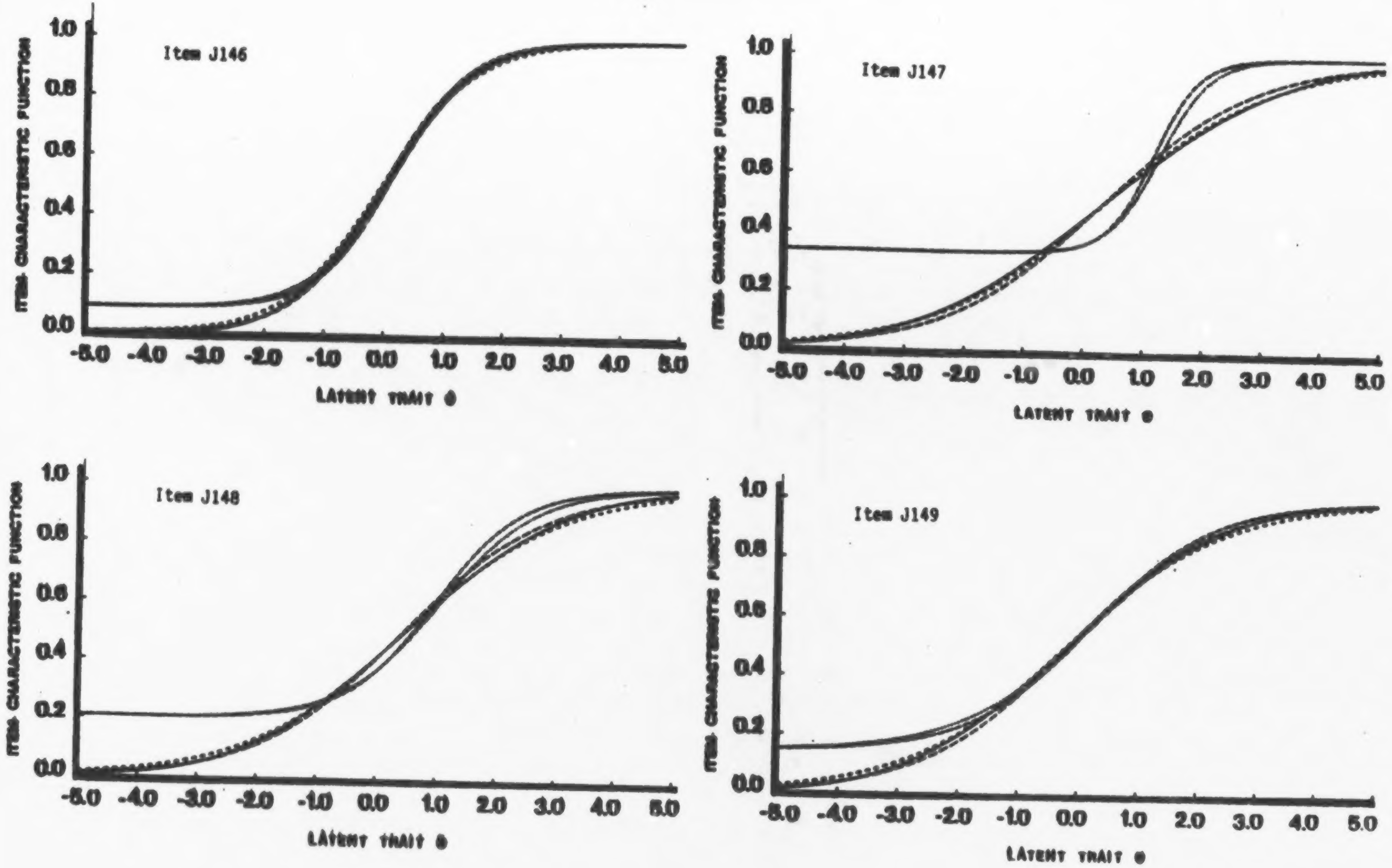

FIGURE 9-5 (Continued)

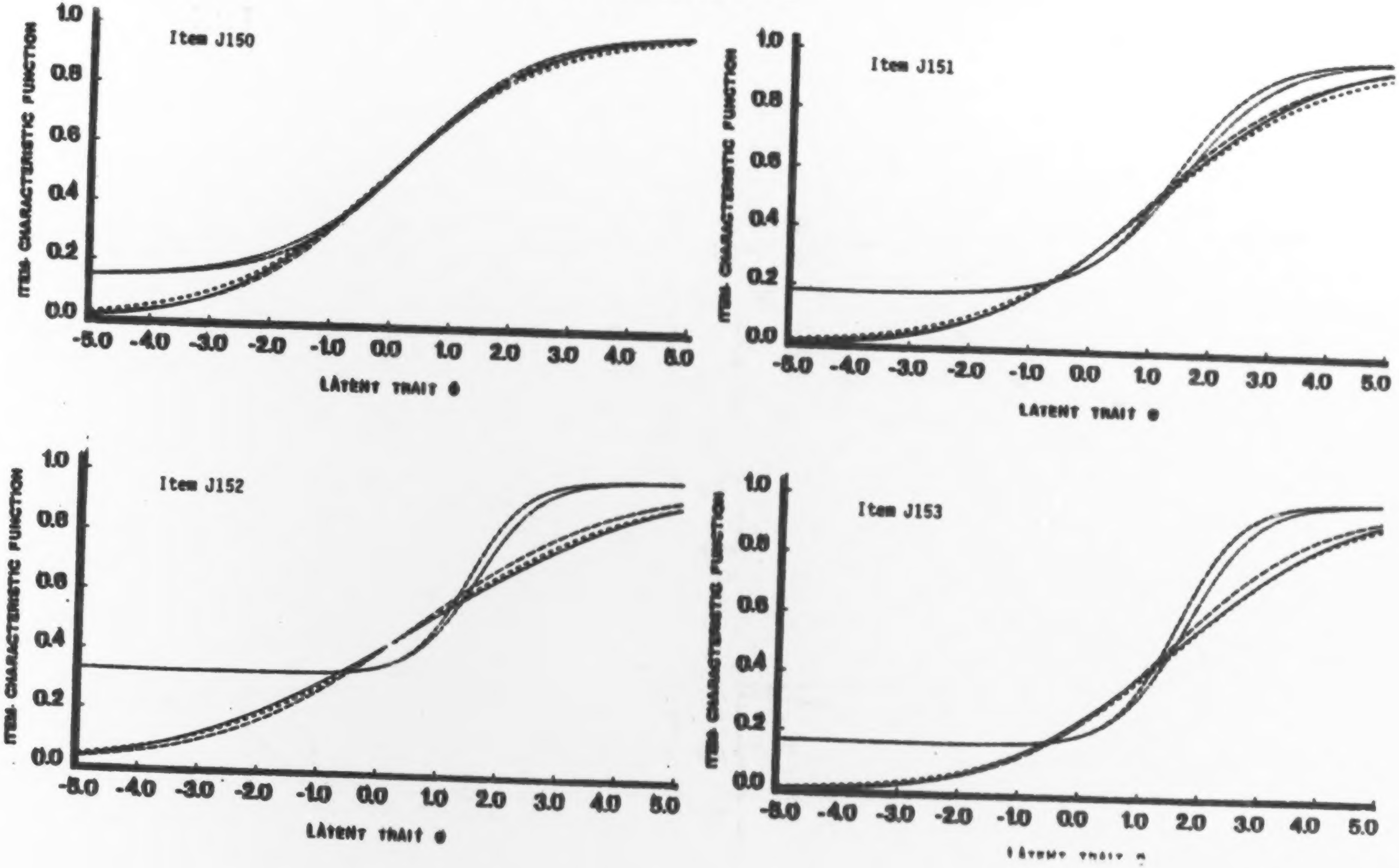

FIGURE 9-5 (Continued)

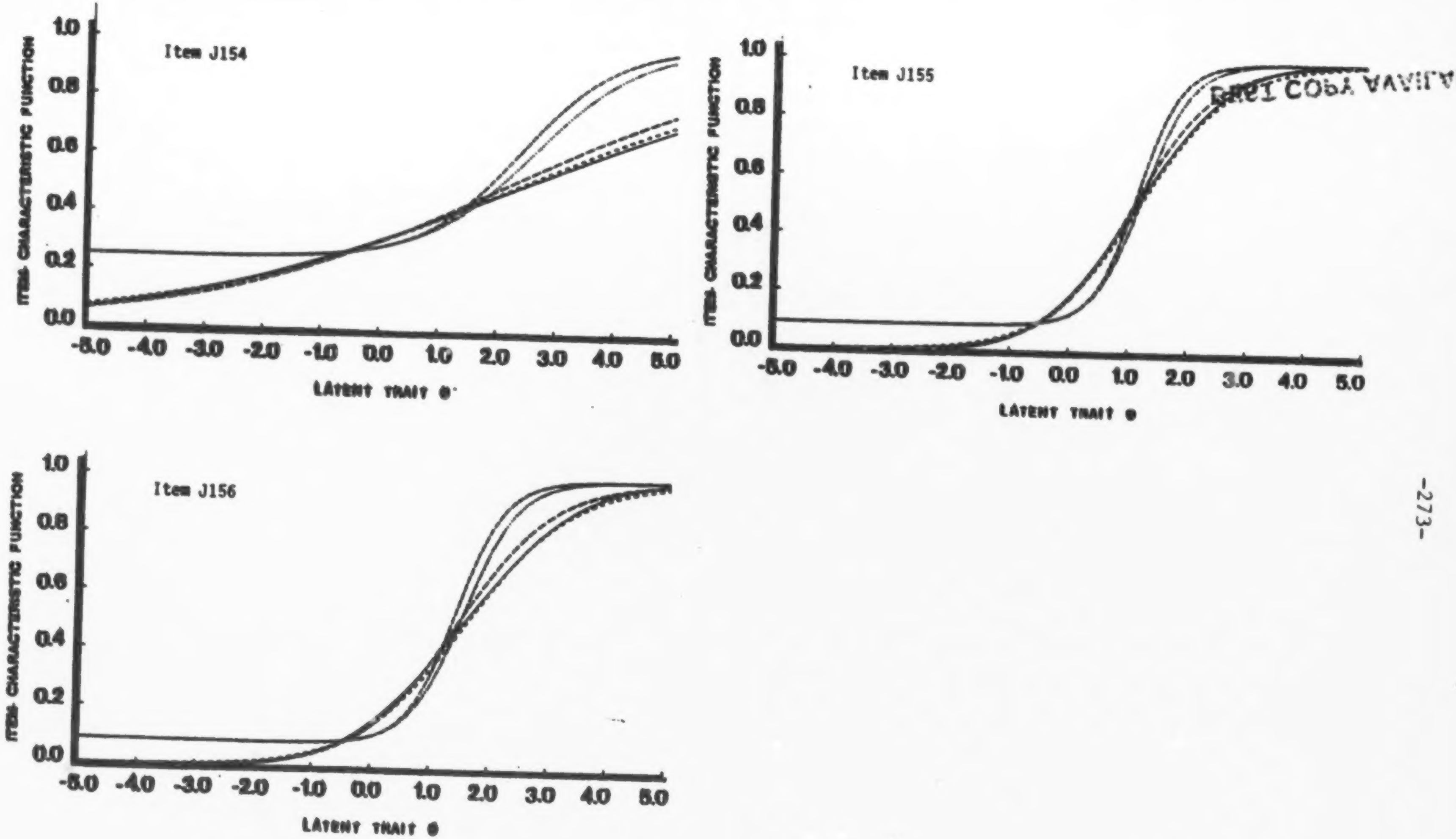

FIGURE 9-5 (Continued)

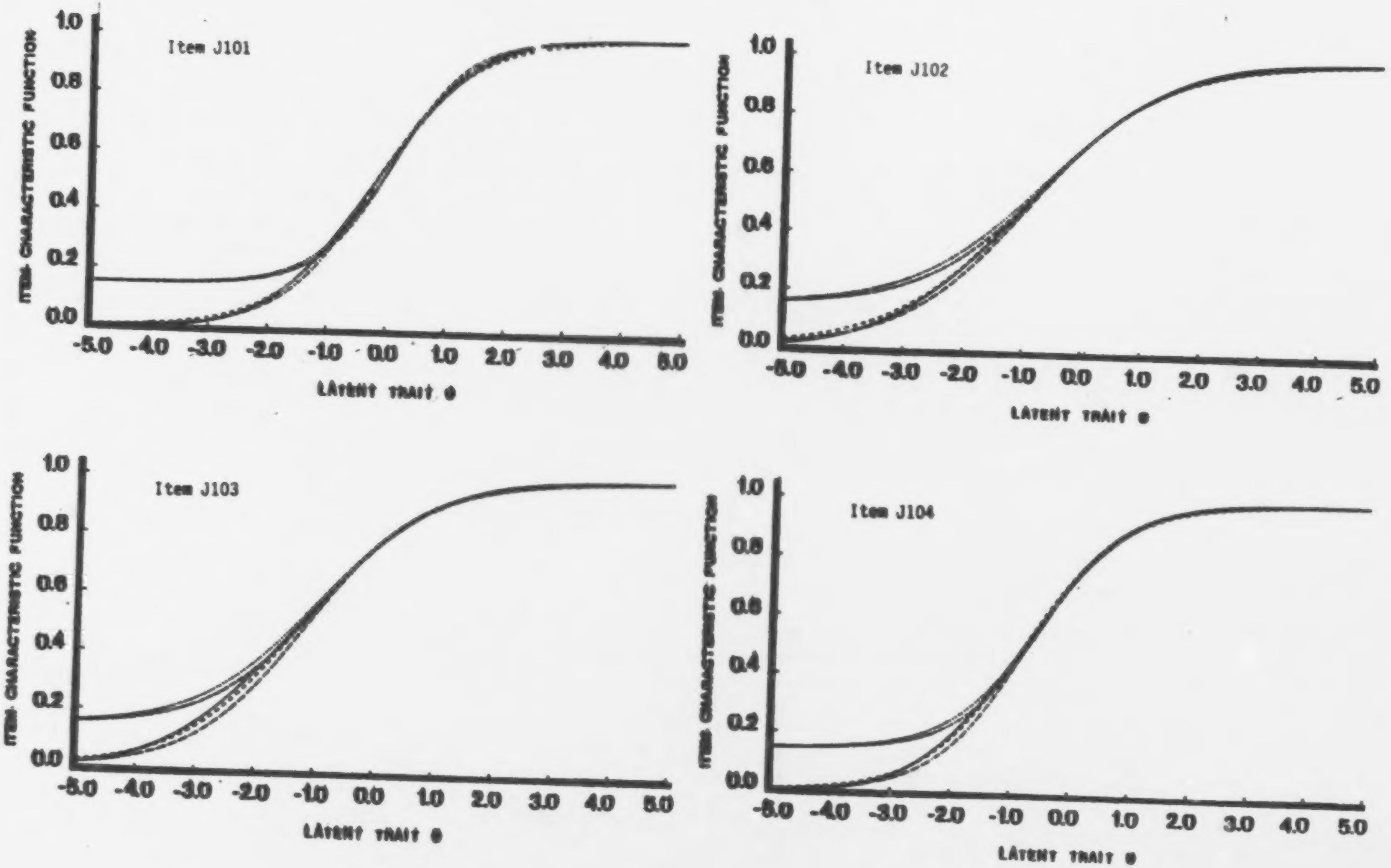

FIGURE 9-6

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Two Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And Two Estimated Item Characteristic Functions Following the Three-Parameter Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1. Results of the J1/2289 Case.

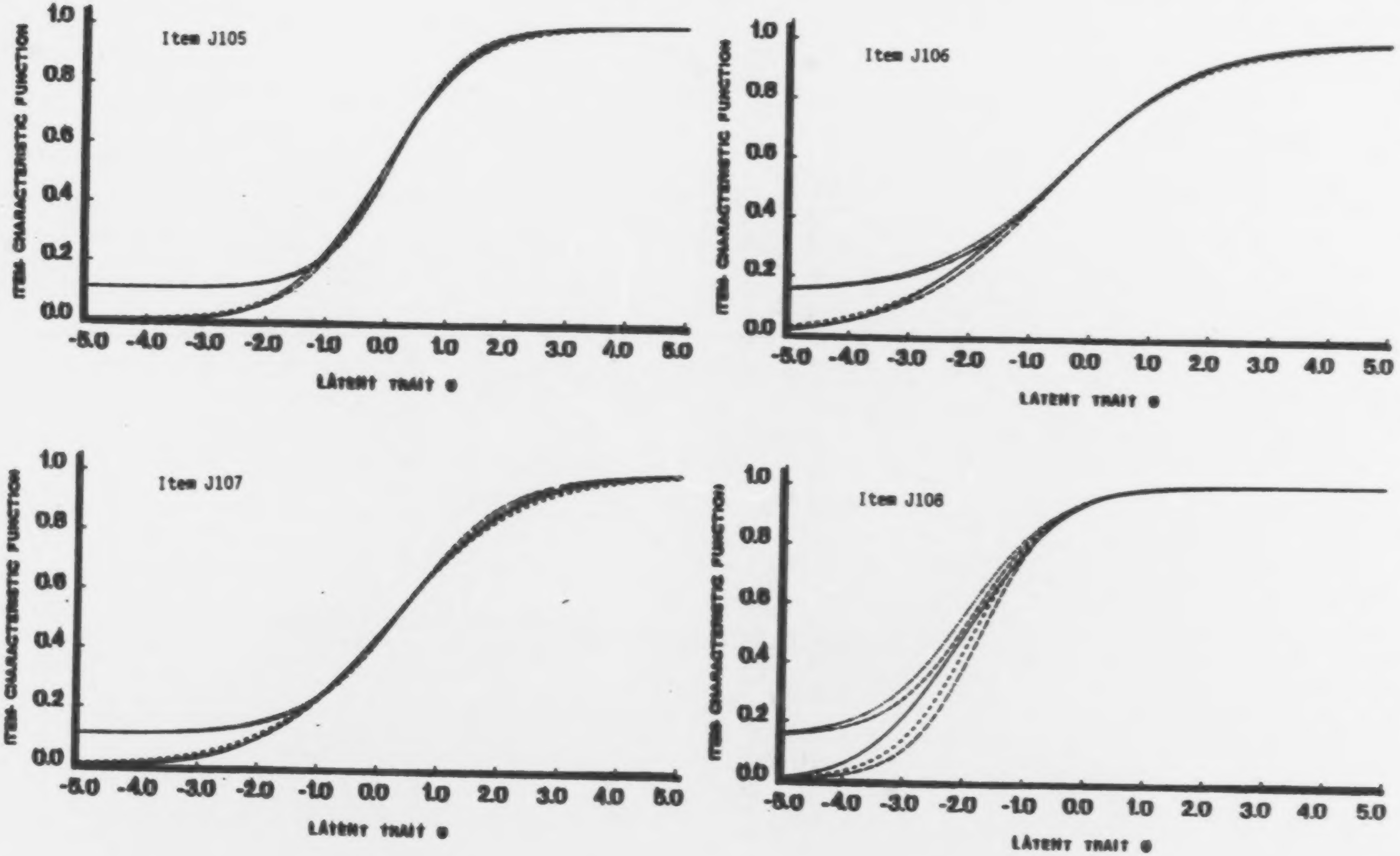

FIGURE 9-6 (Continued)

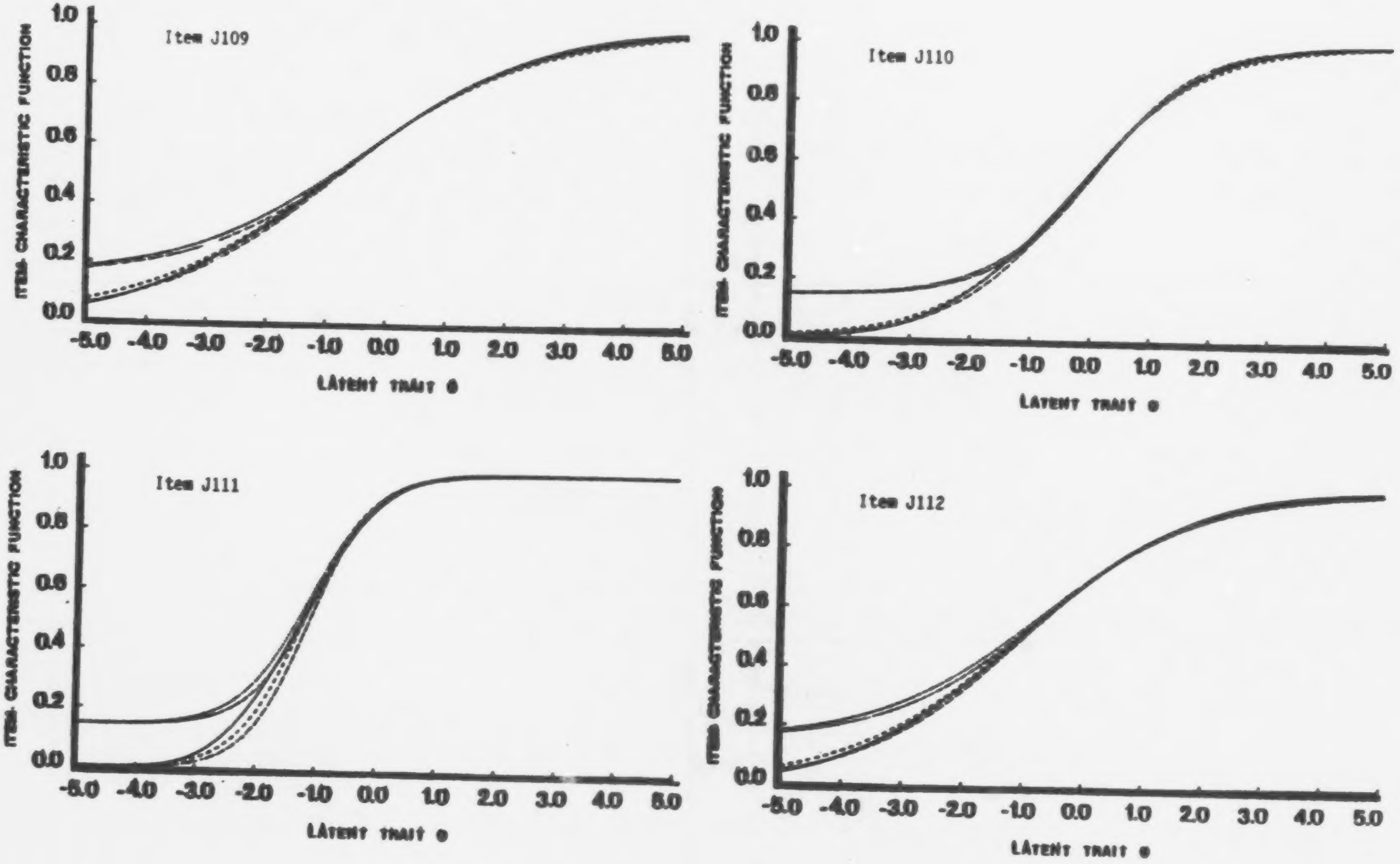

FIGURE 9-6 (Continued)

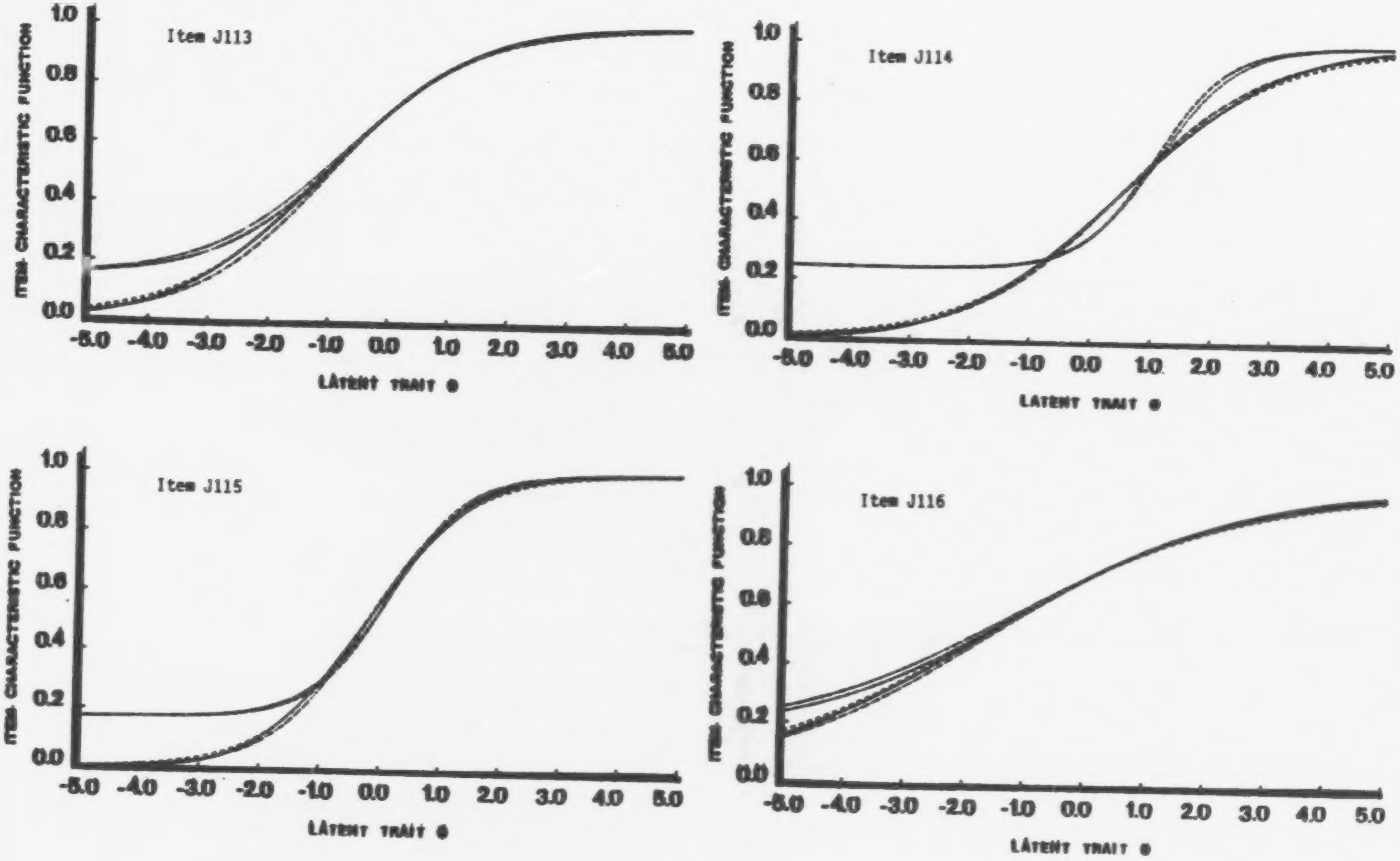

FIGURE 9-6 (Continued)

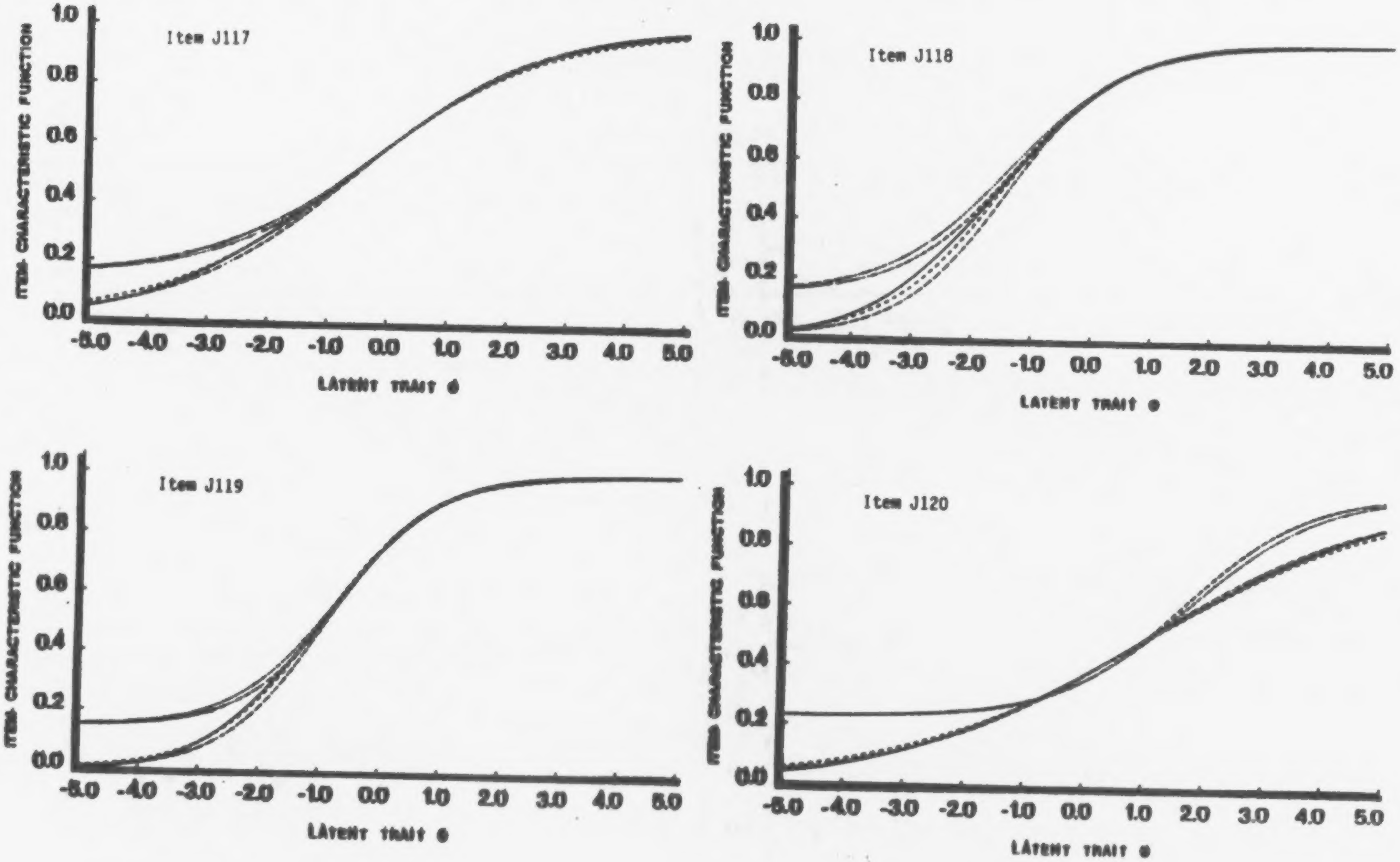

FIGURE 9-6 (Continued)

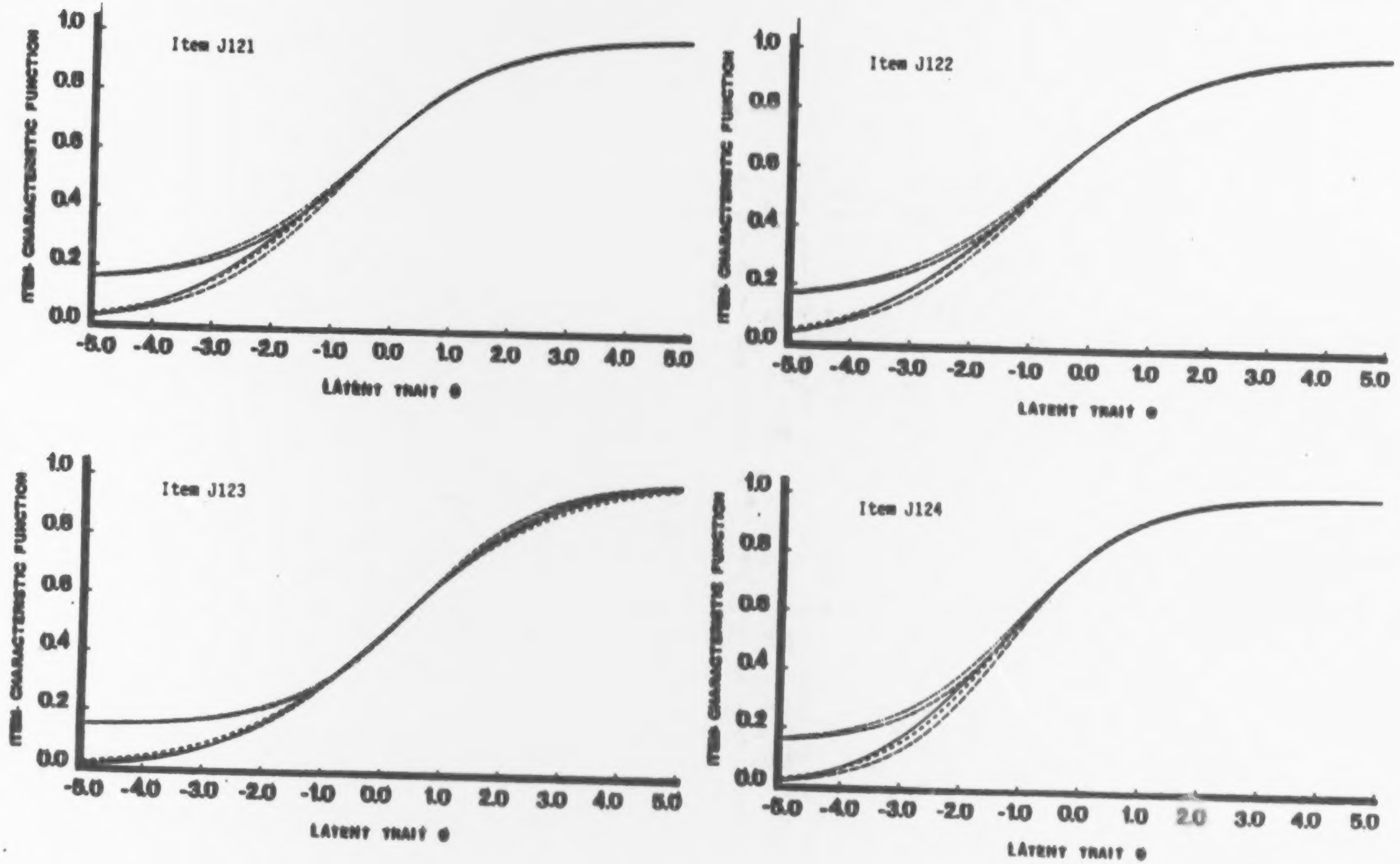

FIGURE 9-6 (Continued)

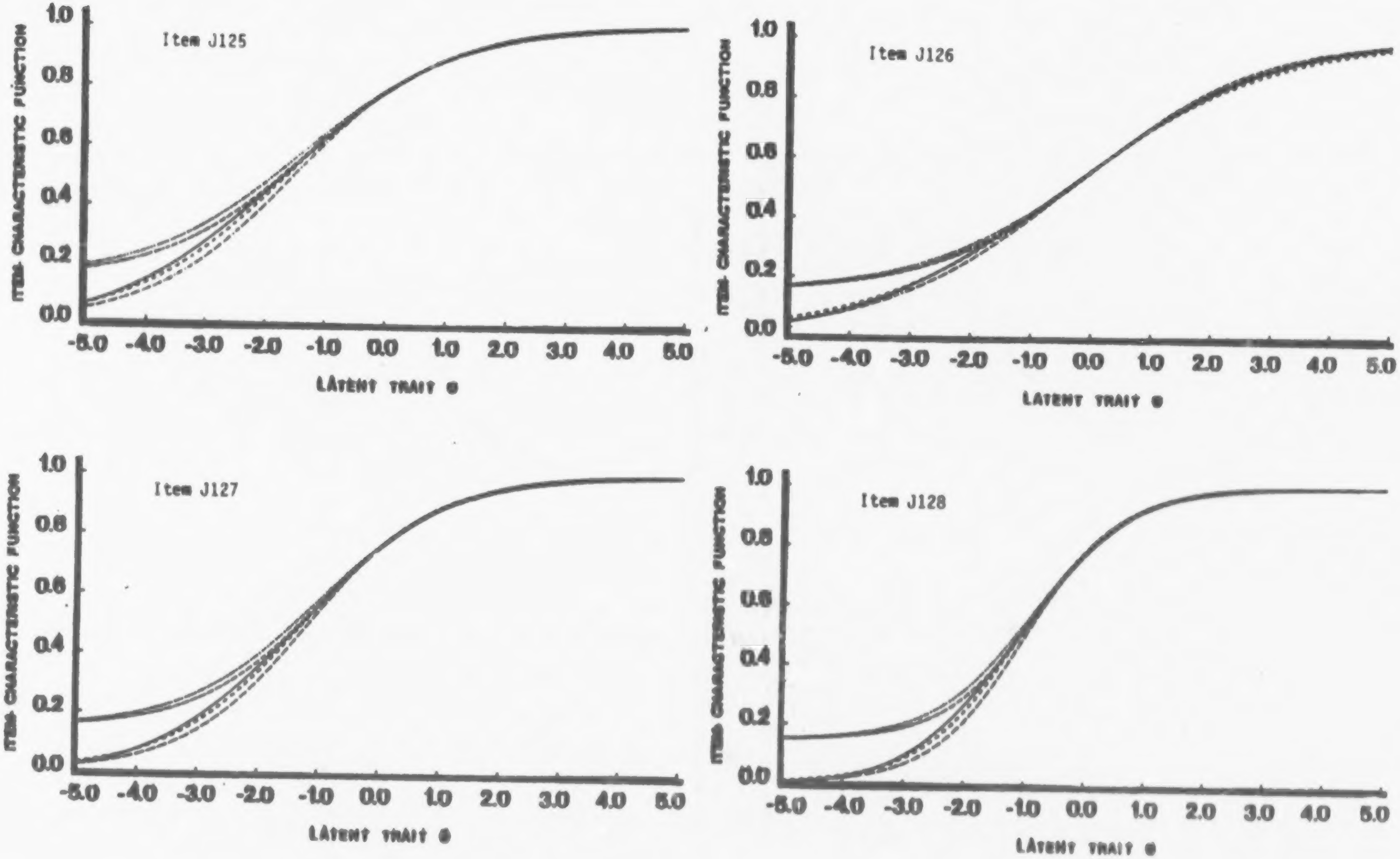

FIGURE 9-6 (Continued)

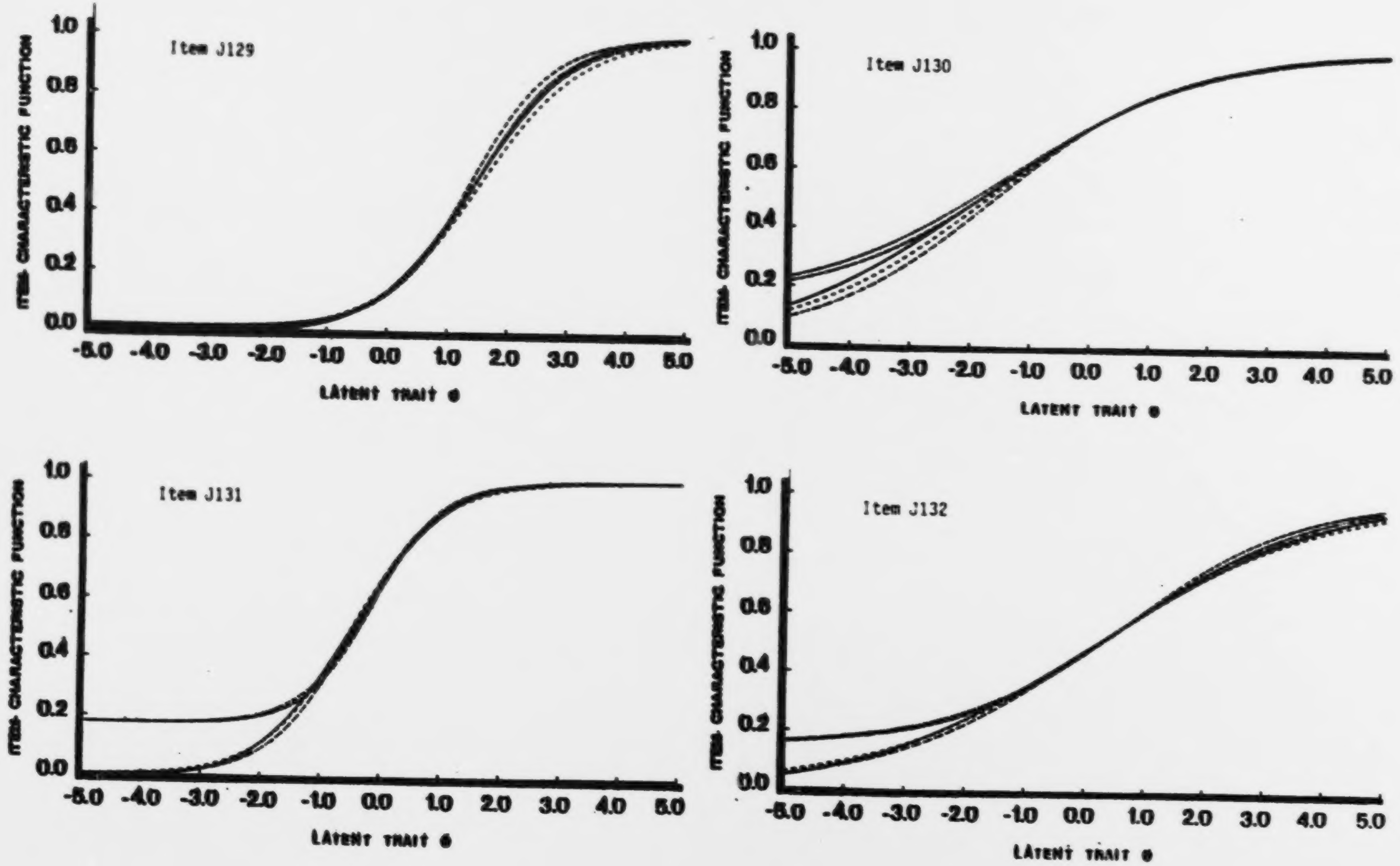

FIGURE 9-6 (Continued)

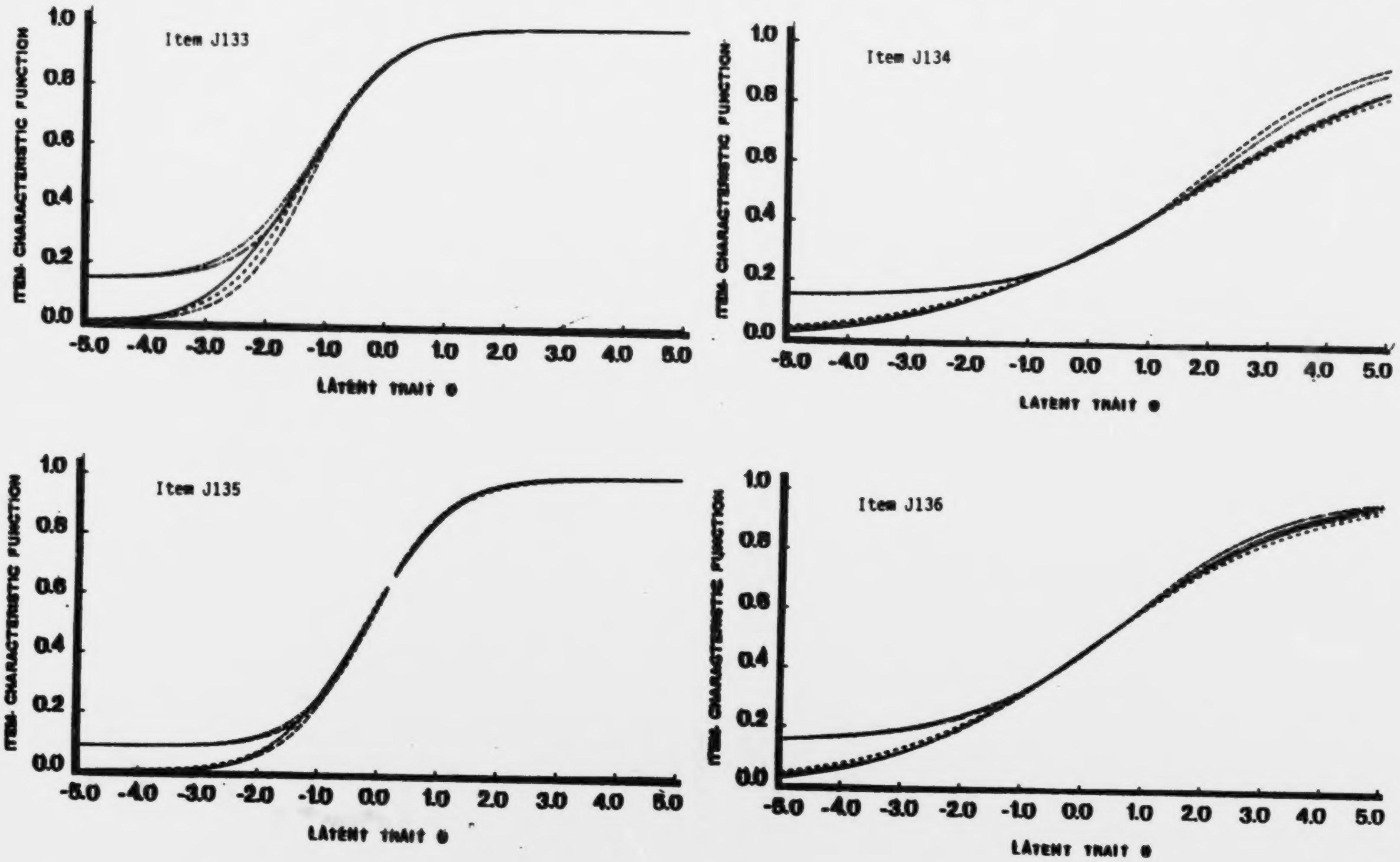

FIGURE 9-6 (Continued)

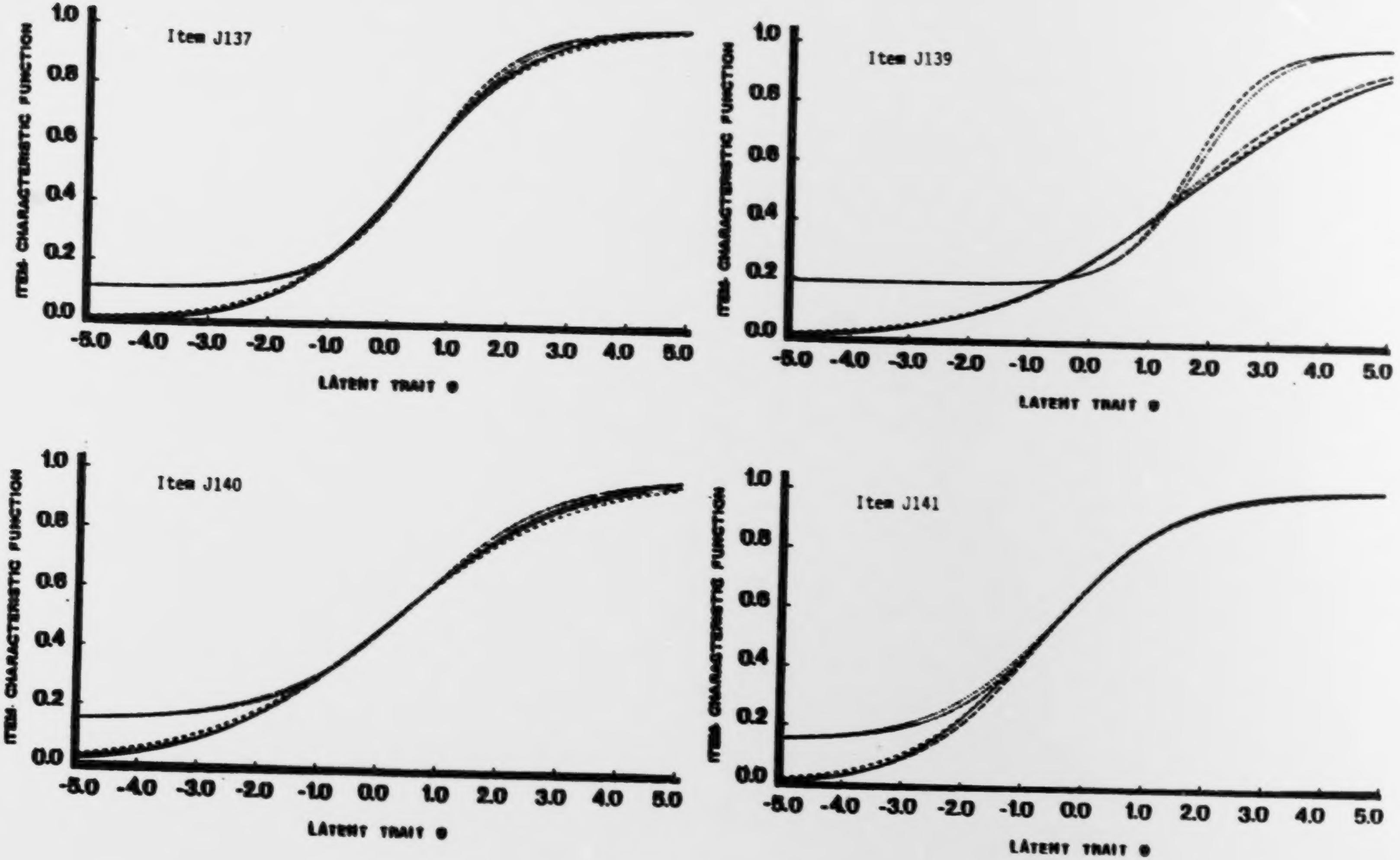

FIGURE 9-6 (Continued)

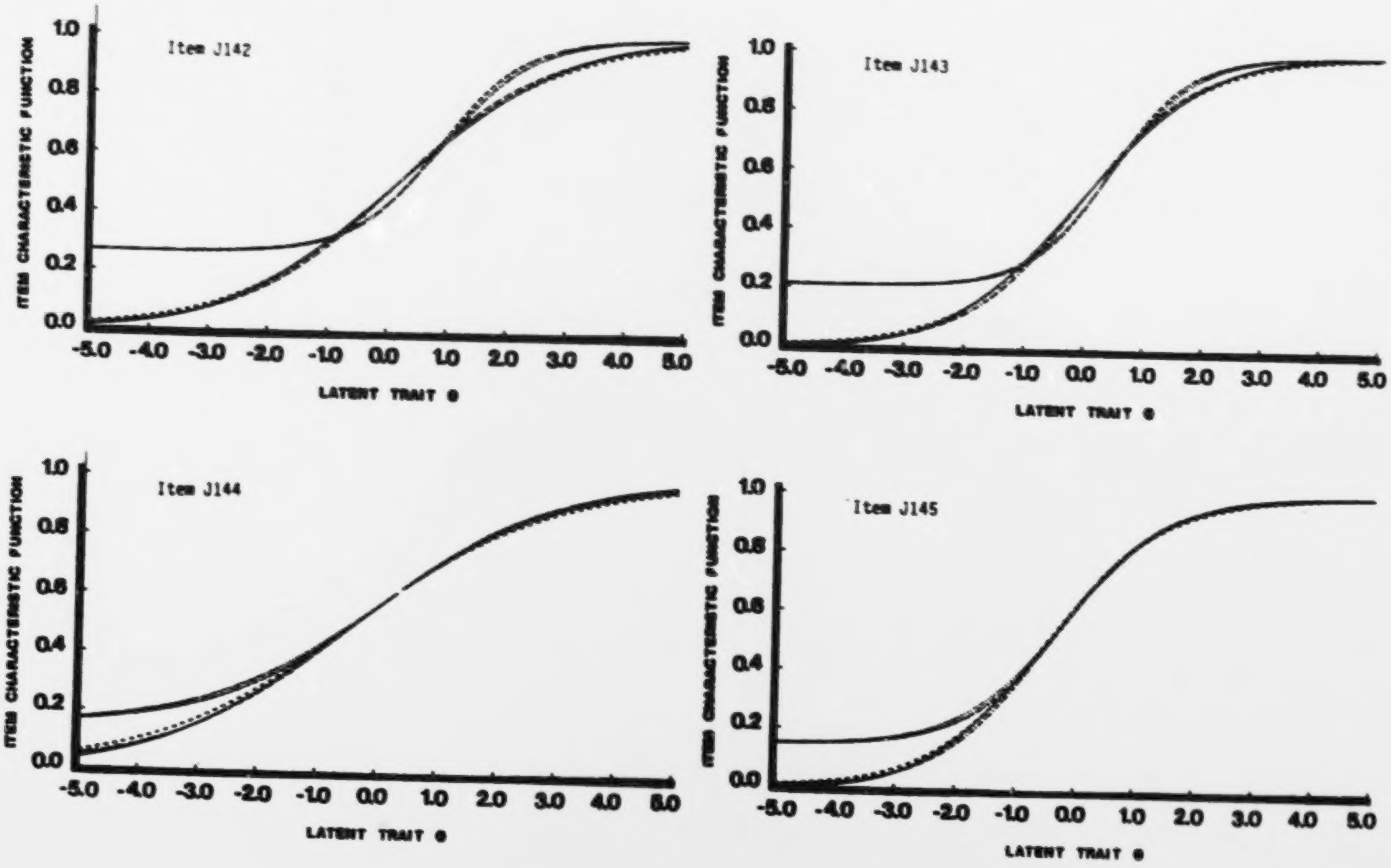

FIGURE 9-6 (Continued)

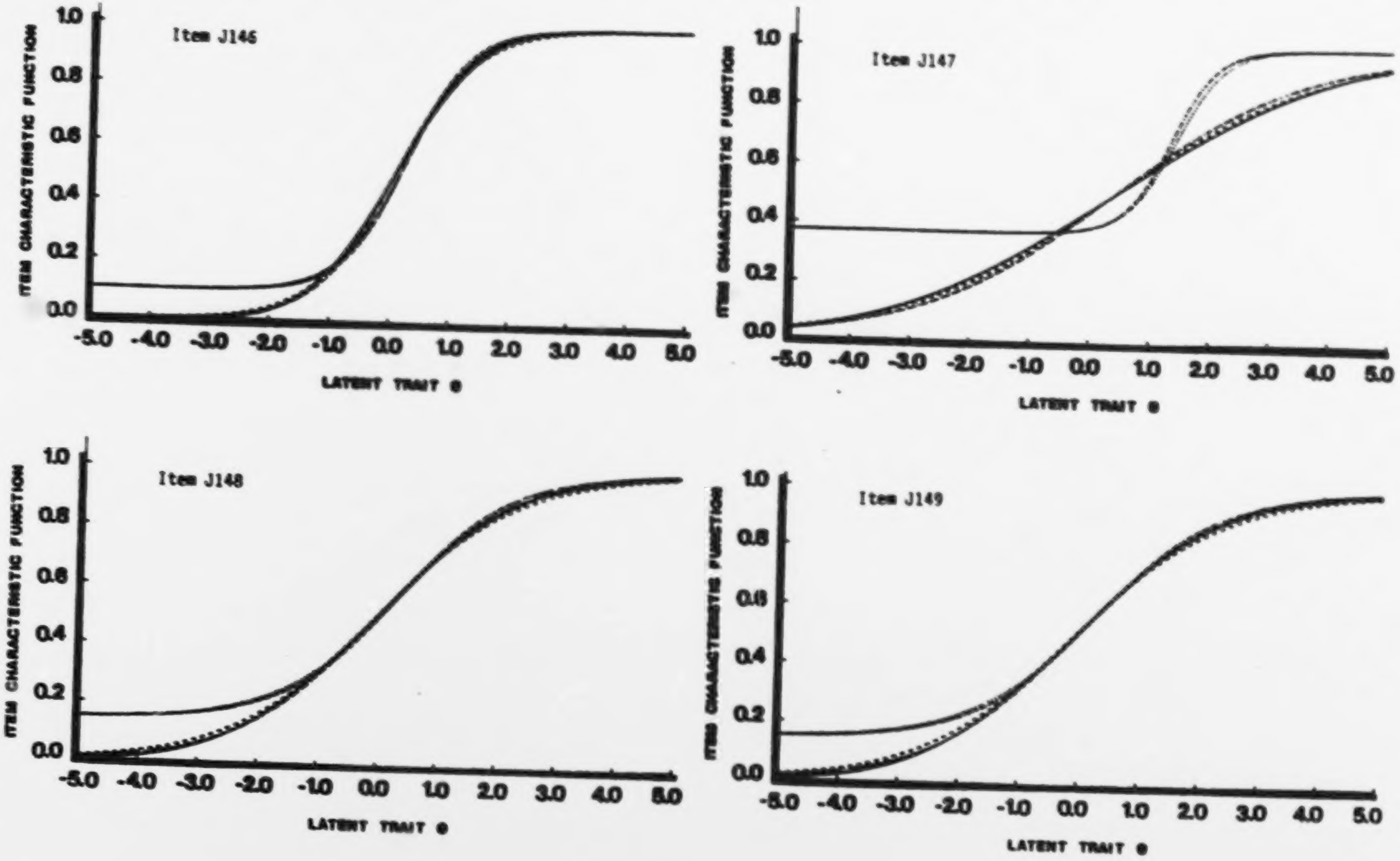

FIGURE 9-6 (Continued)

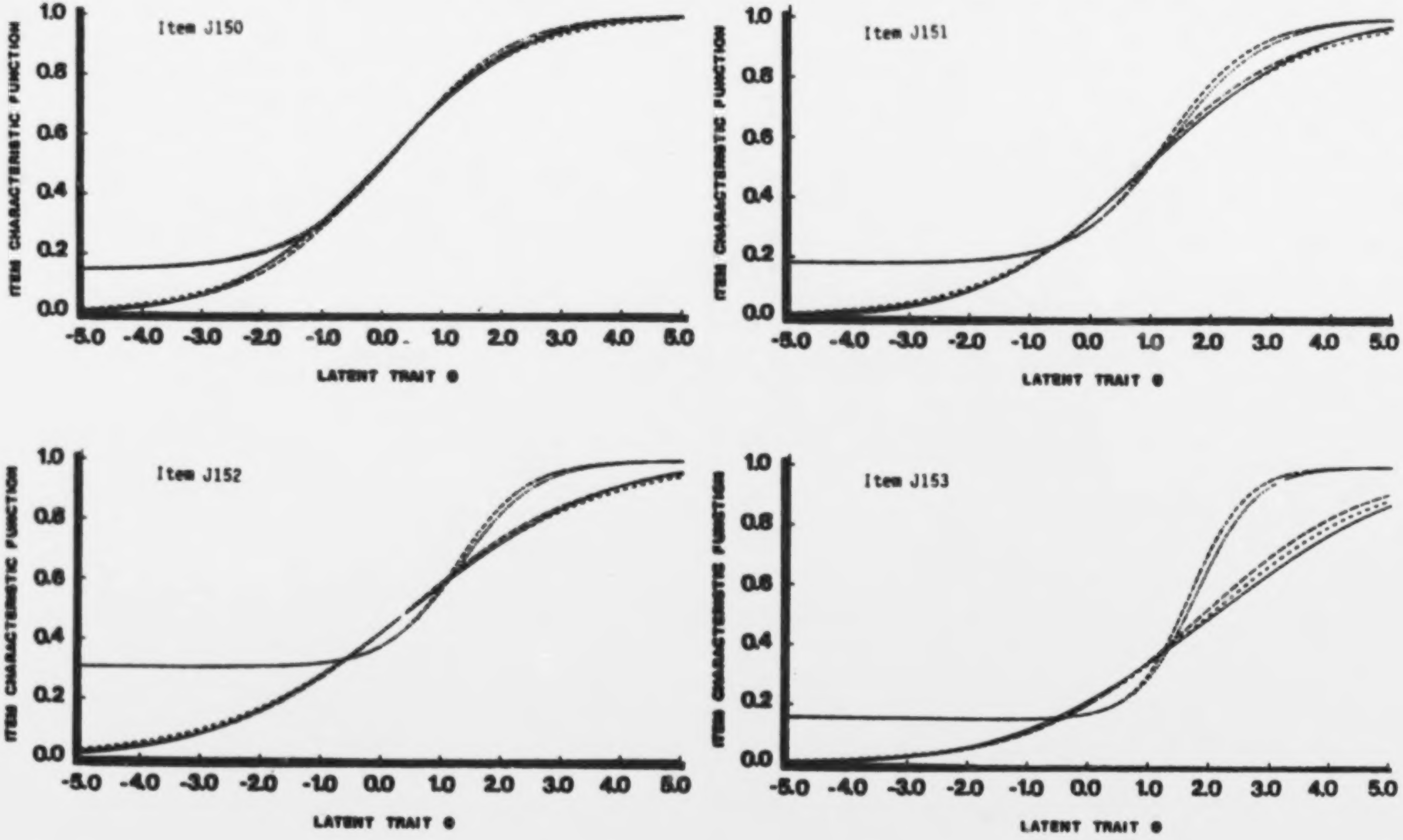

FIGURE 9-6 (Continued)

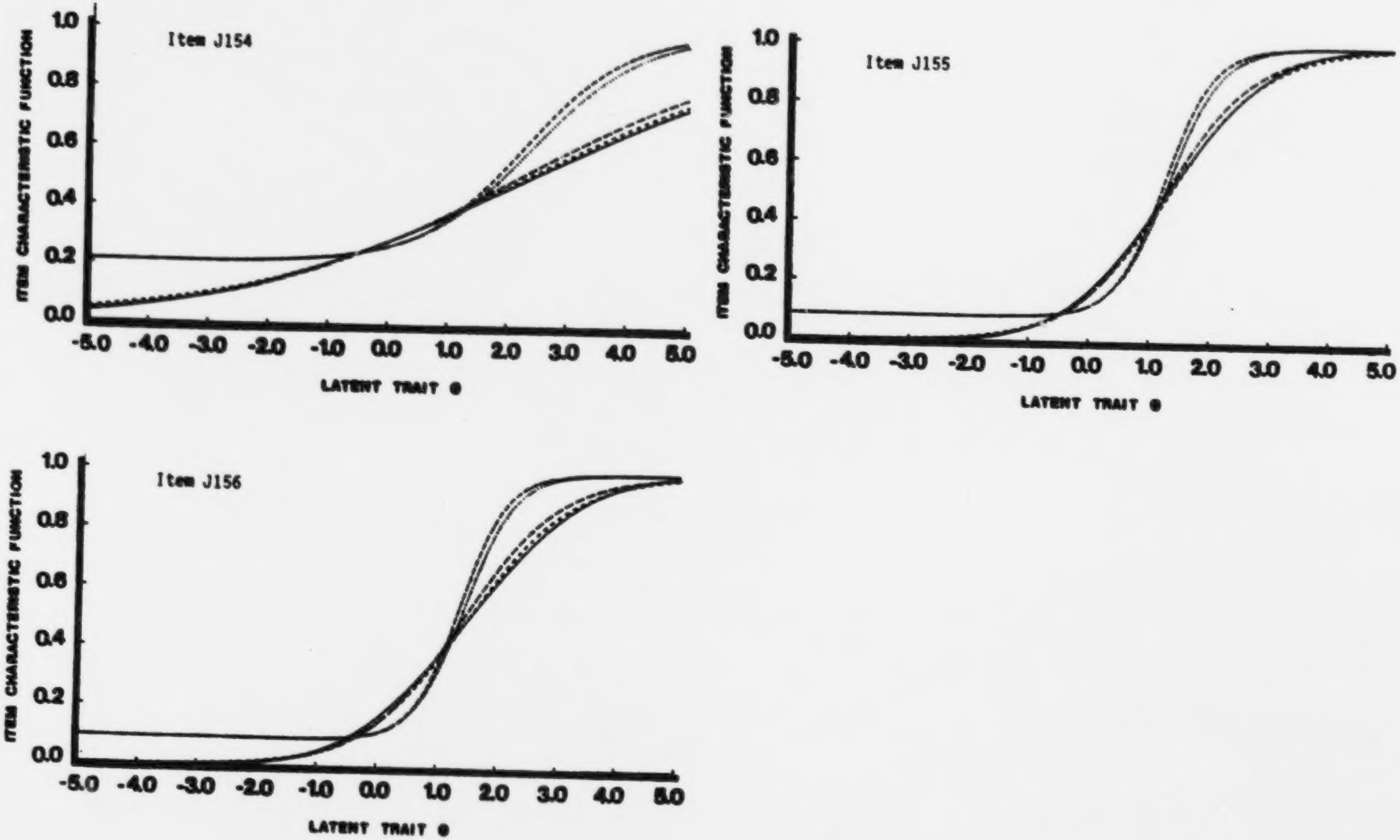

FIGURE 9-6 (Continued)

close to the normal ogive curve, which is drawn by a solid line.

(4) For certain items, the three-parameter logistic curves are drastically different from the other three curves, whereas for many other items they are close to the other three for the range of $\theta$, $(-1.0, \infty)$.

## X. Discussion and Conclusions

Data based upon Shiba's Word/Phrase Comprehension Tests A5, A6, J1 and J2 were analyzed, and the item discrimination and the item difficulty parameters of each item of these tests were estimated by two methods, i.e., Tetrachoric Method and Logist 5. Scale adjustment, or equating, was made in the effort of putting all the estimated item characteristic functions on a single scale of $\theta$. In this process, it was found out that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ seem to be somewhat different from those of the distribution of $\theta$, and a certain systematic tendency has been observed. Further investigation of this tendency will be done in separate paper.

It has been observed by using simulated data (Samejima, ONR/RR-84-3) that the estimated item characteristic functions obtained by Logist 5 by assuming three-parameter logistic model can be drastically different from the true item characteristic function, when the latter follows normal ogive model. This is caused from the fact that in Logist 5 the maximum likelihood estimate $\hat{\theta}$ is treated as if it were $\theta$ itself in estimating the item parameters, and especially on the lower side of $\theta$ the maximum likelihood estimate contains a substantial amount of error (Samejima, 1973; Lord, 1980). More detailed observation and discussion of this problem will be made, again, in a separate paper.

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# APPENDIX

## TABLE A-1

Intermediate Results for Obtaining the Best Fitted Linear Relationships between the Two Sets of Estimated Item Discrimination Parameters of the Overlapping Test Items And between Those of Estimated Difficulty Parameters, Which Were Obtained by Tetrachoric Method. For 14 Overlapping Items of Tests A5 And A6, A5/0599 and A6/0412 Cases.

```
TITLE: SHIBA'S DATA
       A5-0599 VS. A6-0412(TEST 1)


ITEM DISCRIMINATION PARAMETERS


  TEST        SUM OF            MEAN OF            SUM OF             MEAN OF                              STANDARD
            PARAMETERS        PARAMETERS          SQUARES            SQUARES           VARIANCE           DEVIATION
   1      0.95380000D 01    0.68128571D 00    0.71331080D 01     0.50950771D 00    0.45357490D-01    0.21297298D 00
   2      0.80030000D 01    0.57164286D 00    0.49577170D 01     0.35412264D 00    0.27347087D-01    0.16536955D 00


  PRODUCT MOMENT CORRELATION MATRIX

       1    0.10000000000000D 01    0.84092301237745D 00
       2    0.84092301237745D 00    0.10000000000000D 01


  COVARIANCE MATRIX

       1    0.45357489795592D-01    0.29616673469390D-01
       2    0.29616673469390D-01    0.27347086734690D-01


  CROSS PRODUCT MATRIX

       1    0.50950771428570D 00    0.41906878571430D 00
       2    0.41906878571430D 00    0.35412264285710D 00


C **********

  NOTE :  THE FOLLOWING   2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
          FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO   2.00000 (BGMAX)  :

                 ITEMS     2  14

          THUS THE RESULTING NUMBER OF ITEMS IS  14
C **********
```

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

```
ITERATION  6

     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =      1.199495253067

     WEIGHTED CROSS-PRODUCT MATRIX

          1    0.5095077142857D 00    0.5026710191729D 00
          2    0.5026710191729D 00    0.5095077143710D 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                          EIGENVALUE                                              EIGENVECTOR

                   (REAL PART)          (IMAGINARY PART)                 (REAL PART)            (IMAGINARY PART)

          1     0.6836695155515D-02   0.0000000000000D 00          -0.7071067812165D 00     0.0000000000000D 00
                                                                    0.7071067811565D 00     0.0000000000000D 00

          2     0.1012178733501D 01   0.0000000000000D 00          -0.7071067811565D 00     0.0000000000000D 00
                                                                   -0.7071067812165D 00     0.0000000000000D 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =      1.019015428657

     SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX =      1.019015428657

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =     0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =   0.1000000000085D 01

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 =   0.8336839996056D 00

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS =   0.3665857982987D-02
```

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

```
WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

 ITERATION          WEIGHT
                                      S.D. RATIO
                                       (SLOPE)            INTERCEPT
     1
     2          1.000000000000     0.831646872746
     3          1.202433427902     0.833711740337     0.005053723411
     4          1.199455341237     0.833683622317     0.003646958619
     5          1.199495795805     0.833684004736     0.003666115025
     6          1.199495245584     0.833683999535     0.003665854488
                1.199495253067     0.833683999606     0.003665858031
                                                      0.003665857983
```

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

```
ITEM DIFFICULTY PARAMETERS

            SUM OF             MEAN OF            SUM OF            MEAN OF                            STANDARD
  TEST    PARAMETERS         PARAMETERS          SQUARES           SQUARES          VARIANCE           DEVIATION

    1   -0.85950000D 01   -0.61392857D 00   0.93064810D 01   0.66474864D 00   0.28784035D 00   0.53650755D 00
    2   -0.10240000D 01   -0.73142857D-01   0.49998740D 01   0.35713386D 00   0.35178398D 00   0.59311380D 00


   PRODUCT MOMENT CORRELATION MATRIX

        1   0.10000000000000D 01   0.74019780518470D 00
        2   0.74019780518470D 00   0.10000000000000D 01


   COVARIANCE MATRIX

        1   0.287840352040[illegible] 00   0.23553836734469D 00
        2   0.23553836734469D 00   0.35178397959180D 00


   CROSS PRODUCT MATRIX

        1   0.66474864285710D 00   0.28044285714290D 00
        2   0.28044285714290D 00   0.35713385714290D 00


C **********

   NOTE :  THE FOLLOWING   2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
           FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                 ITEMS    2  14

           THUS THE RESULTING NUMBER OF ITEMS IS  14

C **********
```

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TABLE A-1 (Continued): A5/0399 And A6/0412 Cases.

```
ITERATION 22

    WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     0.904560896885

    WEIGHTED COVARIANCE MATRIX

          1    0.2878403520408D 00   0.21305879681182D 00
          2    0.21305879681182D 00   0.28784035202046D 00

    RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                          EIGENVALUE
                                                                            EIGENVECTOR
                 (REAL PART)          (IMAGINARY PART)
                                                                  (REAL PART)          (IMAGINARY PART)
         1     0.50089914885O9D 00   0.0000000000000D 00
                                                             0.70710678120000D 00   0.00000000000000D 00
                                                             0.70710678117310D 00   0.00000000000000D 00
         2     0.74781555214520D-01  0.0000000000000D 00
                                                            -0.70710678117310D 00   0.00000000000000D 00
                                                             0.70710678120000D 00   0.00000000000000D 00

    IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

    SUM OF EIGENVALUES =    0.575680704065

    SUM OF DIAGONALS OF COVARIANCE MATRIX =    0.575680704065

    ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =    0.000000000000

    RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.99999999996190D 00

    ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
    OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 =  0.11055087649770D 01

    (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
     TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

    ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
    DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS =  0.60556055964130D 00

    ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
    USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = -0.54776640296820D 00
```

**TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.**

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

| ITERATION | WEIGHT | S.D. RATIO (SLOPE) | INTERCEPT | MEAN DISTANCE |
|---|---|---|---|---|
| 1 | 1.000000000000 | 1.144909832698 | 0.629750000860 | -0.550043315967 |
| 2 | 0.873431227020 | 1.092011995305 | 0.597274507118 | -0.546948668774 |
| 3 | 0.915740856601 | 1.110285061966 | 0.608492864828 | -0.548051023717 |
| 4 | 0.900669597616 | 1.103837223938 | 0.604534352839 | -0.547666213577 |
| 5 | 0.905930673757 | 1.106096058781 | 0.605921116088 | -0.547801532495 |
| 6 | 0.904080610414 | 1.105302704579 | 0.605434053275 | -0.547754068426 |
| 7 | 0.904729533238 | 1.105581099284 | 0.605604967739 | -0.547770731728 |
| 8 | 0.904501714662 | 1.105483377479 | 0.605544973531 | -0.547764883550 |
| 9 | 0.904581670219 | 1.105517675894 | 0.605566030308 | -0.547766936262 |
| 10 | 0.904553605795 | 1.105505637364 | 0.605558639510 | -0.547766215787 |
| 11 | 0.904563456035 | 1.105509862755 | 0.605561233599 | -0.547766468668 |
| 12 | 0.904559998685 | 1.105508379683 | 0.605560323098 | -0.547766379909 |
| 13 | 0.904561212179 | 1.105508900226 | 0.605560642675 | -0.547766411063 |
| 14 | 0.904560786254 | 1.105508717521 | 0.605560530506 | -0.547766400128 |
| 15 | 0.904560935750 | 1.105508781649 | 0.605560569876 | -0.547766403966 |
| 16 | 0.904560883278 | 1.105508759140 | 0.605560556058 | -0.547766402619 |
| 17 | 0.904560901695 | 1.105508767040 | 0.605560560908 | -0.547766403092 |
| 18 | 0.904560895231 | 1.105508764268 | 0.605560559206 | -0.547766402926 |
| 19 | 0.904560897500 | 1.105508765241 | 0.605560559803 | -0.547766402984 |
| 20 | 0.904560896704 | 1.105508764899 | 0.605560559593 | -0.547766402964 |
| 21 | 0.904560896983 | 1.105508765019 | 0.605560559667 | -0.547766402971 |
| 22 | 0.904560896885 | 1.105508764977 | 0.605560559641 | -0.547766402968 |

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0.    S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = -0.54776640296820 00    S.D. OF POP. 2 = 0.90456089691950 00

SLOPE = 0.11055087649770 01    INTERCEPT = 0.60556055964130 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0.    S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = -0.55041134012530 00    S.D. OF POP. 2 = 0.86839964672420 00

SLOPE = 0.11515435361730 01    INTERCEPT = 0.63382262095750 00

## TABLE A-1 (Continued):

For 14 Overlapping Items of Tests A6 and J1, A6/0412 And J1/0614 Cases.

```
TITLE: SHIBA'S DATA
       A6-0412 VS. J1-0614(TEST 1)


ITEM DISCRIMINATION PARAMETERS


   TEST        SUM OF            MEAN OF            SUM OF            MEAN OF                              STANDARD
             PARAMETERS        PARAMETERS          SQUARES            SQUARES           VARIANCE           DEVIATION
     1     0.86120000D 01    0.61514286D 00    0.55404400D 01    0.39574571D 00    0.17344980D-01    0.13170034D 00
     2     0.85160000D 01    0.60828571D 00    0.56974460D 01    0.40696043D 00    0.36948918D-01    0.19222101D 00


   PRODUCT MOMENT CORRELATION MATRIX

       1    0.10000000000000D 01    0.52350449819700D 00
       2    0.52350449819700D 00    0.10000000000000D 01


   COVARIANCE MATRIX

       1    0.17344979591184D-01    0.13252816326653D-01
       2    0.13252816326653D-01    0.36948918367350D-01


   CROSS PRODUCT MATRIX

       1    0.39574571428570D 00    0.38743542857140D 00
       2    0.38743542857140D 00    0.40696042857140D 00


C **********

     NOTE :  THE FOLLOWING   2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
             FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                   ITEMS    8  14

             THUS THE RESULTING NUMBER OF ITEMS IS  14

C **********
```

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

```
ITERATION  7


     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     0.986125113863

     WEIGHTED CROSS-PRODUCT MATRIX

          1     0.39574571428570 00    0.38205980611440 00
          2     0.38205980611440 00    0.39574571430910 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                        EIGENVALUE                                         EIGENVECTOR

               (REAL PART)          (IMAGINARY PART)              (REAL PART)          (IMAGINARY PART)

          1     0.13685908183010-01   0.00000000000000 00          -0.70710678119740 00   0.00000000000000 00
                                                                     0.70710678117570 00   0.00000000000000 00

          2     0.77780552041180 00   0.00000000000000 00          -0.70710678117570 00   0.00000000000000 00
                                                                    -0.70710678119740 00   0.00000000000000 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =    0.791491428595

     SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX =    0.791491428595

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =    0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.10000000000310 01

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 =  0.10140701073050 01

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.15512268864930-01
```

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

| ITERATION | WEIGHT | S.D. RATIO (SLOPE) | INTERCEPT |
|---|---|---|---|
| 1 | 1.000000000000 | 1.014577739339 | -0.015824535085 |
| 2 | 0.985631717735 | 1.014051927940 | -0.015501085958 |
| 3 | 0.986142792541 | 1.014070758520 | -0.015512669455 |
| 4 | 0.986124480564 | 1.014070083976 | -0.015512254515 |
| 5 | 0.986125136518 | 1.014070108139 | -0.015512269378 |
| 6 | 0.986125113021 | 1.014070107274 | -0.015512268846 |
| 7 | 0.986125113863 | 1.014070107305 | -0.015512268865 |

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

```
ITEM DIFFICULTY PARAMETERS


TEST           SUM OF            MEAN OF              SUM OF              MEAN OF                                STANDARD
             PARAMETERS        PARAMETERS            SQUARES              SQUARES            VARIANCE            DEVIATION

  1       -0.94800000D 01   -0.67714286D 00    0.88560460D 01      0.63257471D 00      0.17405227D 00      0.41719572D 00
  2       -0.37210000D 01   -0.26578571D 00    0.47963270D 01      0.34259479D 00      0.27195274D 00      0.52149088D 00


PRODUCT MOMENT CORRELATION MATRIX

     1    0.10000000000000D 01   0.84674534295595D 00
     2    0.84674534295595D 00   0.10000000000000D 01


COVARIANCE MATRIX

     1    0.17405226530610 00    0.18422110204080 00
     2    0.18422110204080 00    0.27195273979590 00


CROSS PRODUCT MATRIX

     1    0.6325747142857L 00    0.3641960000000D 00
     2    0.3641960000000D 00    0.3425947857143D 00




C **********

   NOTE :  THE FOLLOWING   2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
           FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                   ITEMS    8  14

           THUS THE RESULTING NUMBER OF ITEMS IS  14

C **********
```

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

```
ITERATION 14

     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     0.800005772627

     WEIGHTED COVARIANCE MATRIX

          1    0.17405226530610 00   0.14737794507230 00
          2    0.14737794507230 00   0.17405226528910 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                          EIGENVALUE
                                                                          EIGENVECTOR
               (REAL PART)          (IMAGINARY PART)
                                                                (REAL PART)          (IMAGINARY PART)
          1    0.32143021036990 00   0.00000000000000 00
                                                              0.70710678120690 00   0.00000000000000 00
                                                              0.70710678116620 00   0.00000000000000 00
          2    0.26674320225300-01   0.00000000000000 00
                                                             -0.70710678116620 00   0.00000000000000 00
                                                              0.70710678120690 00   0.00000000000000 00

     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =     0.348104530595

     SUM OF DIAGONALS OF COVARIANCE MATRIX =      0.348104530595

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =     0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.99999999994230 00

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 =  0.12499909802640 01

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS =  0.58063674949280 00

     ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
     USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = -0.46451275142030 00
```

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

```
WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

     ITERATION          WEIGHT             S.D. RATIO            INTERCEPT              MEAN
                                            (SLOPE)                                   DISTANCE

         1          1.000000000000      1.300414682155      0.614780799059      -0.472757503814
         2          0.768985473420      1.241081834236      0.574603984897      -0.462986379339
         3          0.805748639948      1.251610256184      0.581733230616      -0.464787842495
         4          0.798970761912      1.249698127475      0.580438446319      -0.464462923932
         5          0.800193245084      1.250043991803      0.580672645878      -0.464521768582
         6          0.799971846237      1.249981385820      0.580630252684      -0.464511119342
         7          0.800011913253      1.249992716808      0.580637925381      -0.464513046815
         8          0.800004661270      1.249990665975      0.580636536675      -0.464512697958
         9          0.800005973820      1.249991037161      0.580636788020      -0.464512761099
        10          0.800005736258      1.249990969979      0.580636742528      -0.464512749671
        11          0.800005779255      1.249990982138      0.580636750762      -0.464512751739
        12          0.800005771473      1.249990979937      0.580636749272      -0.464512751365
        13          0.800005772882      1.249990980336      0.580636749542      -0.464512751433
        14          0.800005772627      1.249990980264      0.580636749493      -0.464512751420


     WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

          MEAN OF POP. 1 =  0.                      S.D. OF POP. 1 =  1.

          MEAN OF POP. 2 = -0.4645127514203D 00     S.D. OF POP. 2 =  0.8000057726729D 00

          SLOPE =           0.1249990980264D 01     INTERCEPT =       0.5806367494928D 00

     WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

          MEAN OF POP. 1 =  0.                      S.D. OF POP. 1 =  1.

          MEAN OF POP. 2 = -0.4377494503856D 00     S.D. OF POP. 2 =  0.9007008047842D 00

          SLOPE =           0.1110246593195D 01     INTERCEPT =       0.4860098359637D 00
```

## TABLE A-1 (Continued):

For 16 Overlapping Items of Tests J2 and J1, J2/0758 And J1/0614 Cases.

```
TITLE: SHIBA'S DATA
       J2-0758 VS. J1-0614(TEST 1)


ITEM DISCRIMINATION PARAMETERS


                  SUM OF           MEAN OF           SUM OF            MEAN OF                                STANDARD
  TEST          PARAMETERS        PARAMETERS         SQUARES           SQUARES           VARIANCE             DEVIATION
   1          0.80920000D 01    0.50575000D 00    0.44159780D 01    0.275998620 00    0.20215563D-01      0.14218144D 00
   2          0.11114000D 02    0.69462500D 00    0.83597860D 01    0.52248662D 00    0.39982734D-01      0.19995683D 00


  PRODUCT MOMENT CORRELATION MATRIX

        1     0.10000000000000D 01    0.39975935731210 00
        2     0.39975935731210 00     0.10000000000000D 01


  COVARIANCE MATRIX

        1     0.2021556250000D-01    0.1136521875000D-01
        2     0.1136521875000D-01    0.3998273437500D-01


  CROSS PRODUCT MATRIX

        1     0.2759986250000D 00    0.3626718125000D 00
        2     0.3626718125000D 00    0.5224866250000D 00




C **********

  NOTE :  THE FOLLOWING   3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
          FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

               ITEMS     4   7  17

          THUS THE RESULTING NUMBER OF ITEMS IS  16
C **********
```

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

```
ITERATION  9

     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     0.726801592904

     WEIGHTED CROSS-PRODUCT MATRIX

          1    0.27599862500000D 00   0.26359045102640D 00
          2    0.26359045102640D 00   0.27599862500041D 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                         EIGENVALUE                                          EIGENVECTOR

                 (REAL PART)         (IMAGINARY PART)                (REAL PART)          (IMAGINARY PART)

          1    0.1240817397564D-01   0.0000000000000D 00         -0.7071067811893D 00   0.0000000000000D 00
                                                                   0.7071067811838D 00   0.0000000000000D 00

          2    0.5395890760285D 00   0.0000000000000D 00         -0.7071067811838D 00   0.0000000000000D 00
                                                                  -0.7071067811893D 00   0.0000000000000D 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =    0.551997250004

     SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX =    0.551997250004

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =    0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.1000000000008D 01

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 =  0.1375891315830D 01

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1232032980777D-02
```

**TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.**

```
WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

   ITERATION          WEIGHT               S.D. RATIO            INTERCEPT
                                            (SLOPE)

       1          1.000000000000       1.395984896675       -0.011394361494
       2          0.716340128308       1.374952668070       -0.000757311876
       3          0.727297763205       1.375935517220       -0.001254387834
       4          0.726778244682       1.375889235142       -0.001230980673
       5          0.726802692004       1.375891413775       -0.001232082517
       6          0.726801541160       1.375891311218       -0.001232030649
       7          0.726801595334       1.375891316046       -0.001232033090
       8          0.726801592784       1.375891315819       -0.001232032975
       9          0.726801592904       1.375891315830       -0.001232032981
```

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

```
ITEM DIFFICULTY PARAMETERS

   TEST       SUM OF           MEAN OF            SUM OF            MEAN OF                              STANDARD
            PARAMETERS       PARAMETERS          SQUARES            SQUARES          VARIANCE           DEVIATION

     1    0.863800000D 01   0.539875000D 00   0.123767700D 02   0.773548120D 00   0.482083110D 00   0.694322050D 00
     2   -0.118540000D 02  -0.740875000D 00   0.146885140D 02   0.918032120D 00   0.369136360D 00   0.607565930D 00


    PRODUCT MOMENT CORRELATION MATRIX

         1    0.10000000000000D 01   0.81622762459610D 00
         2    0.81622762459610D 00   0.10000000000000D 01


    COVARIANCE MATRIX

         1    0.48208310937[illegible]0D 00   0.34432270312500D 00
         2    0.344322703125[illegible] 00   0.36913635937500D 00


    CROSS PRODUCT MATRIX

         1    0.77354812500000D 00  -0.55657187500000D-01
         2   -0.55657187500000D-01   0.91803212500000D 00


C **********

    NOTE :  THE FOLLOWING   3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
            FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                   ITEMS    4   7  17

            THUS THE RESULTING NUMBER OF ITEMS IS  16

C **********
```

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

```
ITERATION 16

        WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     1.142792931346

        WEIGHTED COVARIANCE MATRIX

              1    0.48208310937500D 00   0.39348955123332D 00
              2    0.39348955123332D 00   0.48208310939997D 00


        RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                          EIGENVALUE
                                                                    EIGENVECTOR
                  (REAL PART)          (IMAGINARY PART)
                                                             (REAL PART)          (IMAGINARY PART)
           1   0.88593558154200D-01   0.00000000000000D 00
                                                        -0.70710678119976D 00   0.00000000000000D 00
                                                         0.70710678117754D 00   0.00000000000000D 00
           2   0.87557266062050D 00   0.00000000000000D 00
                                                        -0.70710678117754D 00   0.00000000000000D 00
                                                        -0.70710678119976D 00   0.00000000000000D 00

        IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

        SUM OF EIGENVALUES =     0.964166218775

        SUM OF DIAGONALS OF COVARIANCE MATRIX =     0.964166218775

        ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =     0.000000000000

        RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.10000000000031D 01

        ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
        OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 =  0.87504916472810 00

        (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
         TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)


        ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
        DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.12132921678080 01


        ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
        USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT =  0.13865417129840 01
```

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

```
WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

 ITERATION        WEIGHT              S.D. RATIO         INTERCEPT            MEAN
                                       (SLOPE)                              DISTANCE

     1       1.000000000000      0.849347935243     -1.199416716539     1.412161808807
     2       1.177373792890      0.880939805924     -1.216472377723     1.380880248052
     3       1.135151338690      0.873728365042     -1.212579101077     1.387821604051
     4       1.144520471133      0.875346815669     -1.213452862109     1.386253814361
     5       1.142404338600      0.874982163041     -1.213255995272     1.386606546418
     6       1.142880440584      0.875064250755     -1.213300312376     1.386527116529
     7       1.142773229666      0.875045768162     -1.213290334087     1.386544999394
     8       1.142797367159      0.875049929455     -1.213292580665     1.386540973062
     9       1.142791932596      0.875048992545     -1.213292074850     1.386541879583
    10       1.142793156177      0.875049203489     -1.213292188733     1.386541675481
    11       1.142792880690      0.875049155995     -1.213292163093     1.386541721434
    12       1.142792942715      0.875049166688     -1.213292168866     1.386541711088
    13       1.142792928750      0.875049164281     -1.213292167566     1.386541713417
    14       1.142792931894      0.875049164823     -1.213292167859     1.386541712893
    15       1.142792931186      0.875049164701     -1.213292167793     1.386541713011
    16       1.142792931346      0.875049164728     -1.213292167808     1.386541712984


     WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

          MEAN OF POP. 1 =  0.                     S.D. OF POP. 1 =  1.

          MEAN OF POP. 2 =  0.1386541712984D 01    S.D. OF POP. 2 =  0.1142792931310D 01

          SLOPE =           0.8750491647281D 00    INTERCEPT =      -0.1213292167808D 01

     WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

          MEAN OF POP. 1 =  0.                     S.D. OF POP. 1 =  1.

          MEAN OF POP. 2 =  0.1468885831893D 01    S.D. OF POP. 2 =  0.1253937346912D 01

          SLOPE =           0.7974880104358D 00    INTERCEPT =      -0.1171418839634D 01
```

TABLE A-1 (Continued):

For 51 Overlapping Items of Test J1, J1/1075 And J1/0614 Cases.

```
TITLE: SHIBA'S DATA
       J1-1074 VS. J1-0614(TEST 1)


ITEM DISCRIMINATION PARAMETERS


             SUM OF            MEAN OF            SUM OF            MEAN OF                              STANDARD
 TEST      PARAMETERS        PARAMETERS          SQUARES            SQUARES           VARIANCE           DEVIATION
   1     0.28444000D 02    0.557725490D 00   0.169502760D 02   0.332358350D 00   0.21300631D-01    0.145947360D 00
   2     0.29880403D 02    0.585890260D 00   0.188496660D 02   0.369601300D 00   0.26333899D-01    0.162277230D 00


  PRODUCT MOMENT CORRELATION MATRIX

      1   0.10000000000000D 01   0.89183491937820D 00
      2   0.89183491937820D 00   0.10000000000000D 01


  COVARIANCE MATRIX

      1   0.21300630526720D-01   0.21122157751330D-01
      2   0.21122157751330D-01   0.26333898570260D-01


  CROSS PRODUCT MATRIX

      1   0.33235835294120D 00   0.34788809124730D 00
      2   0.34788809124730D 00   0.36960129751060D 00

C **********

  NOTE :  THE FOLLOWING   4 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
          FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BCMIN)  TO    2.00000 (BCMAX)  :

                ITEMS    8  20  34  53

          THUS THE RESULTING NUMBER OF ITEMS IS  51
C **********
```

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

```
ITERATION  6


     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     0.948279922320

     WEIGHTED CROSS-PRODUCT MATRIX

          1     0.33235835294120 00   0.32989529214420 00
          2     0.32989529214420 00   0.33235835294040 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                         EIGENVALUE                                         EIGENVECTOR

              (REAL PART)         (IMAGINARY PART)                  (REAL PART)          (IMAGINARY PART)

        1      0.66225364508500 00   0.00000000000000 00           0.70710678118700 00   0.00000000000000 00
                                                                   0.70710678118610 00   0.00000000000000 00

        2      0.24630607965680-02   0.00000000000000 00          -0.70710678118610 00   0.00000000000000 00
                                                                   0.70710678118700 00   0.00000000000000 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =     0.664716705882

     SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX =     0.664716705882

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =     0.000000000000


     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.99999999999880 00


     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 =  0.10545409392960 01

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)


     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.22541004421440-02
```

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

| ITERATION | WEIGHT | S.D. RATIO (SLOPE) | INTERCEPT |
|---|---|---|---|
| 1 | 1.000000000000 | 1.054958746346 | -0.002487122084 |
| 2 | 0.947904364473 | 1.054537820491 | -0.002252361006 |
| 3 | 0.948282726867 | 1.054540962581 | -0.002254113429 |
| 4 | 0.948279901382 | 1.054540939122 | -0.002254100345 |
| 5 | 0.948279922478 | 1.054540939297 | -0.002254100443 |
| 6 | 0.948279922320 | 1.054540939296 | -0.002254100442 |

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

```
ITEM DIFFICULTY PARAMETERS

            SUM OF            MEAN OF            SUM OF            MEAN OF                            STANDARD
TEST      PARAMETERS        PARAMETERS          SQUARES            SQUARES          VARIANCE          DEVIATION

  1     -0.157370000D 02  -0.308568630D 00  0.458001210D 02  0.898041590D 00  0.802826990D 00  0.896006130D 00
  2     -0.278642460D 02  -0.546357770D 00  0.475788830D 02  0.932919280D 00  0.634412470D 00  0.796500140D 00


  PRODUCT MOMENT CORRELATION MATRIX

     1     0.10000000000000D 01    0.97620902485890D 00
     2     0.97620902485890D 00    0.10000000000000D 01


  COVARIANCE MATRIX

     1     0.80282699038883D 00    0.69669012666550D 00
     2     0.69669012666550D 00    0.63441246932030D 00


  CROSS PRODUCT MATRIX

     1     0.89804158823530D 00    0.86527899333030D 00
     2     0.86527899333030D 00    0.93291928031390D 00


C **********

  NOTE :  THE FOLLOWING   4 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
          FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)   TO    2.00000 (BGMAX)   :

                  ITEMS    8  20  34  53

          THUS THE RESULTING NUMBER OF ITEMS IS  51

C **********
```

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

```
ITERATION  7


     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =    1.124929037174

     WEIGHTED COVARIANCE MATRIX

          1    0.8028269903883D 00   0.7837269533981D 00
          2    0.7837269533981D 00   0.8028269903489D 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                        EIGENVALUE
                                                                      EIGENVECTOR
               (REAL PART)          (IMAGINARY PART)
                                                                (REAL PART)           (IMAGINARY PART)
          1    0.1586553943767D 01   0.0000000000000D 00
                                                              0.7071067811954D 00   0.0000000000000D 00
                                                              0.7071067811777D 00   0.0000000000000D 00
          2    0.1910003697046D-01   0.0000000000000D 00
                                                             -0.7071067811777D 00   0.0000000000000D 00
                                                              0.7071067811954D 00   0.0000000000000D 00

     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =    1.605653980737

     SUM OF DIAGONALS OF COVARIANCE MATRIX =    1.605653980737

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =    0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.9999999999749D 00

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 =  0.8889449617972D 00

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2720572415696D 00

     ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
     USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT =  0.3060450908227D 00
```

**TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.**

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

| ITERATION | WEIGHT | S.D. RATIO (SLOPE) | INTERCEPT | MEAN DISTANCE |
|---|---|---|---|---|
| 1 | 1.000000000000 | 0.886410407510 | -0.272839325507 | 0.307802484262 |
| 2 | 1.128145598841 | 0.889006821065 | -0.272038153740 | 0.306002324497 |
| 3 | 1.124850761889 | 0.888943454293 | -0.272057706738 | 0.306046133108 |
| 4 | 1.124930944900 | 0.888944990537 | -0.272057230233 | 0.306045065421 |
| 5 | 1.124928990709 | 0.888944960902 | -0.272057241846 | 0.306045091441 |
| 6 | 1.124929038334 | 0.888944961820 | -0.272057241563 | 0.306045090807 |
| 7 | 1.124929037174 | 0.888944961797 | -0.272057241570 | 0.306045090823 |

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0.

S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = 0.30604509082270 00

S.D. OF POP. 2 = 0.11249290372020 01

SLOPE = 0.88894496179720 00

INTERCEPT = -0.27205724156960 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0.

S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = 0.28650596555820 00

S.D. OF POP. 2 = 0.10891665269970 01

SLOPE = 0.91813324704050 00

INTERCEPT = -0.26305065245450 00

## TABLE A-1 (Continued):

For 50 Overlapping Items of Test J1, J1/2259 And J1/0614 Cases.

```
TITLE: SHIBA'S DATA
       J1-2259 VS. J1-0614(TEST 1)


ITEM DISCRIMINATION PARAMETERS


         SUM OF            MEAN OF            SUM OF             MEAN OF                              STANDARD
TEST     PARAMETERS        PARAMETERS         SQUARES            SQUARES          VARIANCE            DEVIATION

  1      0.280650000D 02   0.561300000D 00    0.168066350D 02    0.336132700D 00  0.210750100D-01     0.145172350D 00
  2      0.278779600D 02   0.557559190D 00    0.168182990D 02    0.336365980D 00  0.254937240D-01     0.159667540D 00


     PRODUCT MOMENT CORRELATION MATRIX

          1    0.10000000000000D 01   0.87668806322215D 00
          2    0.87668806322215D 00   0.10000000000000D 01


     COVARIANCE MATRIX

          1    0.21075010000000D-01   0.20321025680093D-01
          2    0.20321025680093D-01   0.25493723623470D-01


     CROSS PRODUCT MATRIX

          1    0.33613270000000D 00   0.33327900076170D 00
          2    0.33327900076170D 00   0.33636597742130D 00

C **********

     NOTE :  THE FOLLOWING   5 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
             FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                  ITEMS     8  20  30  34  53

             THUS THE RESULTING NUMBER OF ITEMS IS  50

C **********
```

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

```
ITERATION  5

    WEIGHT ASSIGNED TO TEST 2 PARAMETERS =    0.999653178539

    WEIGHTED CROSS-PRODUCT MATRIX

         1    0.33613270000000D 00   0.33316341245160D 00
         2    0.33316341245160D 00   0.33613270000150D 00


    RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                         EIGENVALUE                                          EIGENVECTOR

                  (REAL PART)        (IMAGINARY PART)                (REAL PART)        (IMAGINARY PART)

         1      0.29692875491340D-02   0.00000000000000D 00        -0.70710678118730D 00   0.00000000000000D 00
                                                                    0.70710678118580D 00   0.00000000000000D 00

         2      0.66929611245230D 00   0.00000000000000D 00        -0.70710678118580D 00   0.00000000000000D 00
                                                                   -0.70710678118730D 00   0.00000000000000D 00


    IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

    SUM OF EIGENVALUES =    0.672265400001

    SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX =    0.672265400001

    ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =    0.000000000000

    RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.10000000000002D 01

    ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
    OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 =  0.10003469417900D 01

    (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
     TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

    ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
    DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.39355453381460D-02
```

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

| ITERATION | WEIGHT | S.D. RATIO (SLOPE) | INTERCEPT |
|---|---|---|---|
| 1 | 1.000000000000 | 1.000350034417 | -0.003937281230 |
| 2 | 0.999650088064 | 1.000346914228 | -0.003935529867 |
| 3 | 0.999653206080 | 1.000346942036 | -0.003935545476 |
| 4 | 0.999653178291 | 1.000346941788 | -0.003935545337 |
| 5 | 0.999653178539 | 1.000346941790 | -0.003935545338 |

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

```
ITEM DIFFICULTY PARAMETERS

                 SUM OF            MEAN OF             SUM OF             MEAN OF                              STANDARD
TEST           PARAMETERS        PARAMETERS            SQUARES            SQUARES            VARIANCE           DEVIATION

  1        -0.13932000D 02    -0.27864000D 00    0.42542096D 02    0.85084192D 00    0.77320167D 00    0.87931887D 00
  2        -0.28417353D 02    -0.56834706D 00    0.53543449D 02    0.10708690D 01    0.74785060D 00    0.86478356D 00


  PRODUCT MOMENT CORRELATION MATRIX

       1    0.1000000000000D 01    0.9522353454024D 00
       2    0.9522353454024D 00    0.1000000000000D 01


  COVARIANCE MATRIX

       1    0.7732016704000D 00    0.7240992757067D 00
       2    0.7240992757067D 00    0.7478506011339D 00


  CROSS PRODUCT MATRIX

       1    0.8508419200000D 00    0.8824635000518D 00
       2    0.8824635000518D 00    0.1070868979895D 01


C **********

    NOTE :  THE FOLLOWING   5 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
            FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)   TO    2.00000 (BGMAX)   :

                 ITEMS    8  20  30  34  53

            THUS THE RESULTING NUMBER OF ITEMS IS  50

C **********
```

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

```
ITERATION  8


     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     1.016808032255

     WEIGHTED COVARIANCE MATRIX

           1    0.77320167040000D 00    0.7362699596889D 00
           2    0.7362699596889D 00     0.7732016704206D 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                              EIGENVALUE                                      EIGENVECTOR

                   (REAL PART)           (IMAGINARY PART)              (REAL PART)          (IMAGINARY PART)

          1     0.369317107214 4D-01   0.0000000000000D 00      -0.7071067811915D 00    0.0000000000000D 00
                                                                  0.7071067811816D 00    0.0000000000000D 00

          2     0.1509471630099D 01    0.0000000000000D 00      -0.7071067811816D 00    0.0000000000000D 00
                                                                 -0.7071067811915D 00    0.0000000000000D 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =    0

     SUM OF EIGENVALUES =     1.546403340821

     SUM OF DIAGONALS OF COVARIANCE MATRIX =     1.546403340821

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =     0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.1000000000014D 01

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 =  0.9834698077630D 00

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)


     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2943130311382D 00


     ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
     USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT =  0.2992598540545D 00
```

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

```
WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

   ITERATION         WEIGHT            S.D. RATIO          INTERCEPT             MEAN
                                        (SLOPE)                                DISTANCE

       1         1.000000000000     0.982647960869     -0.294542030557     0.299743186050
       2         1.017658449233     0.983511050148     -0.294301539360     0.299235620500
       3         1.016765393586     0.983467739067     -0.294313607560     0.299261069650
       4         1.016810171068     0.983469911529     -0.294313002225     0.299259793080
       5         1.016807924957     0.983469802557     -0.294313032589     0.299259857113
       6         1.016808037623     0.983469808023     -0.294313031066     0.299259853902
       7         1.016808031972     0.983469807749     -0.294313031142     0.299259854063
       8         1.016808032255     0.983469807763     -0.294313031138     0.299259854055


      WHEN SCATTE. DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

         MEAN OF POP. 1 =  0.                     S.D. OF POP. 1 =  1.

         MEAN OF POP. 2 =  0.2992598540545D 00    S.D. OF POP. 2 =  0.1016808032241D 01

         SLOPE =           0.9834698077630D 00    INTERCEPT =      -0.2943130311382D 00

      WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

         MEAN OF POP. 1 =  0.                     S.D. OF POP. 1 =  1.

         MEAN OF POP. 2 =  0.2945629608377D 00    S.D. OF POP. 2 =  0.1008543903576D 01

         SLOPE =           0.9915284763056D 00    INTERCEPT =      -0.2920675637355D 00
```

## TABLE A-1 (Continued):

For 52 Overlapping Items of Test J1, J1/2259 And J1/1075 Cases.

```
TITLE: SHIBA'S DATA
       J1-2259 VS. J1-1074(TEST 1)


ITEM DISCRIMINATION PARAMETERS


              SUM OF            MEAN OF           SUM OF            MEAN OF                              STANDARD
TEST        PARAMETERS        PARAMETERS          SQUARES           SQUARES           VARIANCE           DEVIATION
  1       0.301372320 02    0.57956215D 00    0.18911201D 02    0.36367695D 00    0.27784660D-01    0.16668731D 00
  2       0.28477185D 02    0.54763817D 00    0.16997876D 02    0.32688223D 00    0.26974657D-01    0.16423963D 00


    PRODUCT MOMENT CORRELATION MATRIX

         1      0.1000000000000D 01    0.9452827655565D 00
         2      0.9452827655565D 00    0.1000000000000D 01


    COVARIANCE MATRIX

         1      0.27784660278380-01    0.2587868798142D-01
         2      0.2587868798142D-01    0.2697465742219D-01


    CROSS PRODUCT MATRIX

         1      0.3636769492423D 00    0.3432690474184D 00
         2      0.3432690474184D 00    0.3268822277158D 00

C **********

   NOTE :  THE FOLLOWING   3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
           FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                   ITEMS    8  30  53

           THUS THE RESULTING NUMBER OF ITEMS IS  52
C **********
```

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

```
ITERATION  5

     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     1.054780842012

     WEIGHTED CROSS-PRODUCT MATRIX

          1     0.36367694924230 00    0.36207361487270 00
          2     0.36207361487270 00    0.36367694922740 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                          EIGENVALUE                                          EIGENVECTOR

                   (REAL PART)         (IMAGINARY PART)                (REAL PART)          (IMAGINARY PART)

          1     0.7257505641075D 00   0.0000000000000D 00         0.70710678119380 00   0.0000000000000D 00
                                                                   0.70710678117930 00   0.0000000000000D 00

          2     0.1603334362159D-02   0.0000000000000D 00        -0.70710678117930 00   0.0000000000000D 00
                                                                   0.70710678119380 00   0.0000000000000D 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =    0.727353898470

     SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX =    0.727353898470

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =    0.000000000000

     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.9999999999794D 00

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 =  0.9480642424941D 00

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1823978764064D-02
```

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

| ITERATION | WEIGHT | S.D. RATIO (SLOPE) | INTERCEPT |
|---|---|---|---|
| 1 | 1.000000000000 | 0.947840578724 | -0.001694351708 |
| 2 | 1.055029740704 | 0.948065233039 | -0.001824552847 |
| 3 | 1.054779739991 | 0.948064238108 | -0.001823976222 |
| 4 | 1.054780846914 | 0.948064242514 | -0.001823978775 |
| 5 | 1.054780842012 | 0.948064242494 | -0.001823978764 |

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

```
ITEM DIFFICULTY PARAMETERS


   TEST          SUM OF             MEAN OF             SUM OF             MEAN OF                                STANDARD
               PARAMETERS         PARAMETERS           SQUARES             SQUARES            VARIANCE            DEVIATION

    1        -0.23045380D 02    -0.443180039D 00    0.480074920 02     0.923221010 00     0.726812150 00     0.852532790 00
    2        -0.26333962D 02    -0.506422340 00     0.558762720 02     0.107454370 01     0.818080100 00     0.904477810 00


   PRODUCT MOMENT CORRELATION MATRIX

       1   0.10000000000000D 01   0.96555024801050 00
       2   0.96555024801050 00    0.10000000000000D 01


   COVARIANCE MATRIX

       1   0.72681215176800 00    0.74453288375620 00
       2   0.74453288375620 00    0.81808010043900 00


   CROSS PRODUCT MATRIX

       1   0.92322100799760 00    0.96896933281170 00
       2   0.96896933281170 00    0.10745436868150 01



C **********

     NOTE :  THE FOLLOWING   3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER
             FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM   -2.00000 (BGMIN)  TO    2.00000 (BGMAX)  :

                  ITEMS    8  30  53

             THUS THE RESULTING NUMBER OF ITE4S IS  52

C **********
```

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

```
ITERATION  8

     WEIGHT ASSIGNED TO TEST 2 PARAMETERS =     0.942569050615

     WEIGHTED COVARIANCE MATRIX

          1    0.72681215176800 00    0.70177365339360 00
          2    0.70177365339360 00    0.72681215176170 00


     RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

                          EIGENVALUE
                                                                          EIGENVECTOR
                (REAL PART)          (IMAGINARY PART)
                                                                (REAL PART)          (IMAGINARY PART)
          1     0.14285858051580 01   0.00000000000000 00
                                                             0.70710678118810 00   0.00000000000000 00
                                                             0.70710678118500 00   0.00000000000000 00

          2     0.25038498371220-01   0.00000000000000 00   -0.70710678118500 00   0.00000000000000 00
                                                             0.70710678118810 00   0.00000000000000 00


     IMSL SUBROUTINE IEGRF ERROR PARAMETER ( IER ) =   0

     SUM OF EIGENVALUES =      1.453624303530

     SUM OF DIAGONALS OF COVARIANCE MATRIX =     1.453624303530

     ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS =     0.000000000000


     RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT =  0.99999999999550 00

     ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
     OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 =  0.10609302303560 01

     (THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
      TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)


     ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
     DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.36238868889280-01


     ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
     USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT =  0.34157636244480-01
```

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

```
WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

      ITERATION         WEIGHT              S.D. RATIO           INTERCEPT               MEAN
                                             (SLOPE)                                   DISTANCE

          1         1.000000000000       1.063168686223      -0.035246829150      0.033152621598
          2         0.940584512089       1.060850452017      -0.036274225085      0.034193533137
          3         0.942639933931       1.060933076869      -0.036237607371      0.034156355533
          4         0.942566521680       1.060930128796      -0.036238913899      0.034157681939
          5         0.942569140849       1.060930233980      -0.036238867283      0.034157634614
          6         0.942569047400       1.060930230227      -0.036238868947      0.034157636303
          7         0.942569050734       1.060930230361      -0.036238868887      0.034157636242
          8         0.942569050615       1.060930230356      -0.036238868889      0.034157636244


        WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

            MEAN OF POP. 1 =  0.                     S.D. OF POP. 1 =  1.

            MEAN OF POP. 2 =  0.34157636244480-01    S.D. OF POP. 2 =  0.9425690506191D 00

            SLOPE =           0.1060930230356D 01    INTERCEPT =      -0.3623886888928D-01

        WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

            MEAN OF POP. 1 =  0.                     S.D. OF POP. 1 =  1.

            MEAN OF POP. 2 =  0.3554705806374D-01    S.D. OF POP. 2 =  0.9453126535562D 00

            SLOPE =           0.1057851067832D 01    INTERCEPT =      -0.3760349333103D-01
```

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